TEXTILE RESEARCH

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TEXTILE RESEARCH

EDITORIALS

FOREWORD

AN INCREASED membership renders inadequate and impracticable the mimeographed monthly bulletin that has served U. S. Institute members for two years. It also makes possible the more adequate service of this magazine, whose eventual format and character is but meagerly indicated by this first number.

The abstract and bibliography section, which was the principal service rendered by the old monthly bulletin, will cover the most important textile research throughout the world more completely and in a more convenient form. In the case of subjects of unusual importance, however, an effort will be made to publish them complete or at least with more adequate detail than formerly.

An entirely new service that will be made possible as soon as desirable material is available will be the publishing in each issue of one or more progress or final reports of researches conducted in this country. As such work expands more space will be made available for publication of results. It is hoped that this opportunity to present research results to a group of readers who, by membership in U. S. Institute, automatically register their interest therein, will encourage increased textile research in our technical schools and universities and the publication of results.

TEXTILE RESEARCH will also be a forum for discussion and suggestion of research subjects and problems, and it is hoped

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that members will take full advantage of this opportunity. A section will also be devoted to items of news having an interesting or important research character. For this department also contributions are solicited.

The board of editors, the abstractors and contributors to this publication volunteer their services without compensation. In order that TEXTILE RESEARCH may serve the textile industry of the United States as do similar publications abroad it will be necessary for each member of U. S. Institute to cooperate to this end to the extent of his or her ability. TEXTILE RESEARCH cannot perform maximum service for its membership unless each member makes it available to each of his key men and to each individual in his organization who may be interested in new textile knowledge. If one copy is not sufficient to perform this service then additional copies should be subscribed for.

The Annual Meeting

THE third annual meeting of United States Institute for Textile Research, Inc., and the first to be presided over by President Garvan, will be held at the Barbizon-Plaza Hotel, 58th St. and Sixth Ave., New York City, Thursday, November 3, 1932. In accordance with the by-laws the meeting of the corporation is called for 10 A. M., but will be adjourned until 12:30 P. M., at which time luncheon will be served and will be followed by the formal meeting for action upon reports of officers and directors, for election of directors, and for action upon other articles of the agenda.

The Program Committee—Ernest N. Hood, William W. Buffum and Charles H. Clark—hope to secure one or more leading research authorities for the speaking program following the luncheon. They have arranged a symposium on Scientific Textile Research in Progress or Planned, with Chairman Franklin W. Hobbs reporting for The Textile Foundation, Prof. Louis A. Olney for the American Association of Textile Chemists and Colorists, and Dr. W. E. Emley for the Bureau of Standards and the U. S. Institute for Textile Research. Another symposium on

A Program of Economic Research for the Textile Industry will be introduced by Mr. Fessenden S. Blanchard, acting-chairman of U. S. Institute's Committee on Economic Research, and Mr. Paul T. Cherington of that committee. Both of these symposiums will be followed by open discussion. Another important feature of the program will be a report by Dr. Harold DeWitt Smith on the Colloidal Aspects of Textile Chemistry as Presented at the Recent Meeting of the Faraday Society, Dr. Smith having been a participant in that meeting in England last month.

As this issue goes to press before the first formal call for the meeting is mailed it is impossible to present here more complete details of the program. It will be apparent, however, that even the reports of officers and committees will be more interesting than usual, covering as they will the inauguration of this magazine, the publication of our new book TEXTILE RESEARCH: A SURVEY OF PROGRESS, and plans for future efforts along these and other research promotional lines. Members can be certain that the meeting will be well worth a trip to New York City.

"Unless pure science fills up the reservoirs of basic knowledge, in order that the mental equipment of humanity as it exists today can use it, the pace of our development may slow down during the century to come."—President Herbert Hoover.

"Research is the answer determined by scientific methods to the question—Why?"—Scientific Textile Research.

"Cooperative action is the only hope of the textile industry for an adequate program of scientific research."—From "The Why and Whither of Scientific Research," by Dr. W. F. Edwards.

The Key to Accomplishment*

By Vannevar Bush, Eng. D.

Vice-President and Dean of Engineering,
Massachusetts Institute of Technology

CONSIDERING the fact that he has been at it for only a few thousand years, man makes rather good textiles. He even is able to make acceptable textile fibers. Compared to nature, however, he is still an amateur with much to learn. Of course nature has carried on its development over some hundreds of thousands of years, and man cannot wait that long. Fortunately he doesn't have to. He can accomplish in a decade results which would require hundreds of years by empirical methods or thousands of years by processes of evolution and natural selection. This he can do in one way only: by research, intelligent and intensive research vigorously supported and patiently followed up in production. The purpose of this volume is to review some of the more important contemporary research in the textile field.

The first textile research worker sat on a log by a stream and plaited rushes to form a mat. His name is lost to us, if he had one, but his ingenuity was in first-class working order. It probably required many generations before the mat became a basket, and the basket acquired a handle; but the basic idea of interwoven textiles was there born. We still seldom depart from the fundamental scheme of interlacing fibers to form a flexible sheet of material. For some reason or other nature does not seem to have followed out this same line of development; but still we must admit that nature has made better clothes than we.

I have always envied the duck. He can dive under water and come up dry. Yet his coat is pervious to air as it should be for his good health, and it fits beautifully. The duck looks com-

* Introduction to "Textile Research: A Survey of Progress," the new book just published by U. S. Institute for Textile Research, Inc. See back cover of this magazine for prospectus of the book.—*Editor.*

fortable in his waterproof garments on a hot day, but the only raincoat I ever bought was hot, or it wasn't waterproof, and it leaked at the neck when the rain drove horizontally. The Mongolians made a pervious felt that shed rain well, and Caesar thought well enough of it to adopt it. The duck can turn his head in any direction, and yet his covering on his neck lies marvelously smooth and sleek. Columbus found the Indians of Central America using feather garments; but even with their example we still do not emulate the duck, nor do we look natty and comfortable in the rain. It is certainly true that Solomon in all his glory was not arrayed like one of our modern women —not a queen but a woman of the people. We have progressed. Yet the lily can still exhibit more pleasing finish and coloring, to my way of thinking; and the grass of the fields presents me with more alluring gradations of greens and browns than I find in neckties. Moreover the grass takes on more and more attractive hues after long exposure to the sun and rain, and neckties do not.

This is not intended to be a criticism of the textile research worker, who, after all, has been studying his subject for only a short time, and who has produced some marvelous fibers and fabrics. Rather we should note that there is no field of human endeavor in which so much ingenuity and resourcefulness has been shown as in textiles, or which has brought more of lasting benefit to mankind.

When civilization meets a crisis, a world war and a depression, we are reminded forcefully that there are three fundamental needs of man: food, shelter and clothing. Transportation, communication and the rest are contributory rather than basic. There are three primary things we cannot do without, at least in this climate. The supplying of food has given rise to a large number of diversified industries. The furnishing of shelter, again, is in the hands of many groups of widely different types. But the production of clothing, while it involves many branches and is in the hands of a large number of small manufacturing units, is in its interests much nearer to being a closely-knit homogeneous whole. With its importance, the uniqueness of its problems, its size, and its age, certainly the textile industry should be the outstanding exponent of the research method. It is not. There is in this country more real research going on in

communications, or in academic physics, or probably in such a comparatively minor matter as refrigeration, than in the central field of textiles. For this I believe there are two reasons: first a distrust on the part of many textile men of the research method, and second the fact that the textile industry is made up of a very large number of comparatively small units, no one of which thinks it can afford to pay the price of a comprehensive research program. There is real sanity behind each of these reasons, yet they must be overcome, and the burden of overcoming them is on the research worker and on the textile owner and executive. In our modern tempo that industry is in danger which is in a static state. Research, with its yield of new and better products, is not a luxury; it is a necessity, often as a defense against encroachment from without. The world in which we live is going to change, politically and sociologically no doubt, but also technically. We have no choice as to whether we will change with it, we simply have a choice as to whether we will change rapidly enough and sanely enough to remain part of the essential scheme of things, or whether we will pass out of the picture. Looms have operated in much the same way since the time of the early Egyptians. Will they always operate the same way? I do not know anything about looms, but I have lived in a modern research world for some time, and I know they will not. Will we ever make better fibers than nature, in place of what we may call, with due apologies to the hard-working organic chemists, our present weak imitations? Well, there are 100,000 or so known organic compounds, with all sorts of combinations and states of physical aggregation. We have X-rays, and polarized light, and ultracentrifuges with which to study them. There are quite a few thousand men in the world capable of constructive thinking. If we cannot beat a silkworm I am ashamed of the human race.

Speaking of the silkworm, there is one research procedure which is highly attractive because it is so natural. That is to find out what nature does and why it is done that way. In my complete ignorance of textile matters I have lately been asking questions about the silkworm. One I have had partially answered, namely, what materials she uses. (Perhaps *she* is not the correct pronoun, but I did not inquire as to that.) The list of materials, still partial, is almost as long as the silkworm's fiber

and not nearly as simple in configuration. The next question is more difficult. Why does the silkworm use such a complex mixture instead of a relatively simple product? Then too, why does she spin a fiber with a triangular section? There might be an explanation in terms of luster, but presumably she doesn't care unduly for appearances. Possibly it is because there is a higher ratio of drying surface to area for a triangular section than for one that is circular, but if so, why doesn't she go the whole distance and make a fluted affair or a ribbon? Why does she make two fibers simultaneously and carefully cement them together? The reason for this may be that if one spinneret gets temporarily plugged up it will not spoil the show, but if that is true I would like to know how a silkworm clears a spinneret when once it gets plugged without interrupting the spinning process. I'd like to know how a man does it, for that matter. Finally, and this last question involves pure inquisitiveness and nothing else, I'd like to know how a silkworm winds a complete cocoon and finally leaves herself on the inside of it.

To return to the serious aspect of the problem before us, however, let us examine the reasons why there is not more research in textiles. Some will, I know, disagree with me, and contend there is now a great deal more research going on than I have any concept of. Perhaps this is true, but as a simple wearer of clothes I doubt it. It seems to me that the shape gets out of my suit, when I lounge in it, nearly as rapidly as it used to. It is imperfectly elastic, it takes a permanent set, it stretches visibly in places where I do not want it enlarged. The fuzz, or whatever is the proper technical term, still wears off my sleeves when I rub them on my desk. When it is cold I still have to put on an unwieldy number of layers of clothes in order to keep reasonably warm. Still it is only within a few years that the thermal conductivity of textiles has even been scientifically measured. Whether there is a great deal of research under way or not, it appears that there is an opportunity for the profitable employment of more.

There has been a great deal of time and effort wasted in improper or untimely research, and a moderate distrust on the part of the layman is entirely warranted with respect to the type of research which consists simply in mixing things up or

measuring something, without any very clear idea as to the goal, and with no correlation with the recorded results of the literature of the subject. The idea is unfortunately prevalent that one may buy a research laboratory ready-made from the scientific instrument makers, and by hiring a doctorate graduate and turning him loose be securely embarked on a program of research that is bound to yield results that will revolutionize a part of an industry and cause it to produce desirable products with a high margin of profit. The trouble with that scheme is that there is everything present but the program, and the mature and experienced brains to guide it. There is not the slightest question but that well directed and intelligent research pays well in any field in which there are important problems to be solved. There are sufficient examples of this all about us so that the thesis no longer requires demonstration. There need be no distrust of intelligent research. The prime essential to an intelligent research program is not, however, apparatus, or funds, or young research workers; it is a man: a mature research director, with a thorough knowledge of his field, a standing in his profession, a vision of possibilities, a courage to attack the unknown, a patience that is inexhaustible, and a kindly humanity that will cause his co-workers to rally about him with enthusiasm. Find such a man, and the rest of the research laboratory and program will appear. Such men are scarce, and they come high. It is my reasoned opinion, however, that no comprehensive research program can be successful in the long run, except by sheer luck, unless it is centered about such an individual.

There are more of these research directors about than might be suspected offhand, for a life of research is exceedingly attractive to the youngster of inquiring mind; they have simply not as yet been discovered. My advice, then, to the textile or other executive who is considering the launching of a research project, is to seek out a Whitney or a Jewett of about age 30, be very sure you have the right man, and then keep him entirely happy. The results may come slowly, and the more comprehensive is a research the slower it will come to fruition, but they will come nevertheless and they can be as far-reaching in their effect as is necessary to keep an organization busy for a generation.

The question remains, how is an executive to recognize such an individual when he comes in contact with him? There is the recognition which comes to any man of outstanding technical skill, of course, but it does not go far on the matter of scientific vision and judgment. There is the recognition of a man's standing in his profession, his publications, and the opinion of others in his technical field. Unfortunately these operate fully only when a research man has become established and usually somewhat late in his productive life. I believe that the direct approach to the problem is also needed, that the executive today of an important industry involving a complex technique should himself understand research to a sufficient extent to speak the language and to mix freely and usefully with research workers. It is just as necessary, in my opinion, for the modern executive to understand the examination of fibers under polarized light as to know the mechanics of a spinning frame or to be able to read a balance sheet. Of course he cannot hope to know all the underlying optics, any more than he would attempt to operate personally any and all of the machines in his plants, or keep up with all the intricacies of present-day cost accounting systems; but he can understand those things which are important to his business and this is now one of them. The executive today should recognize the outstanding research worker because of his own knowledge of the subject matter of research. Incidentally there is no more fascinating study for any man, whether he is directly interested in the results or not, than the record of the work of the research worker. Of course the story of the great inventor is interesting, and the superficial treatments of the popular technical magazines are well worth while as far as they go. The technical reports themselves, those dry careful records of experiment and conclusion, those painful logical arguments from cause to effect, have a fascination all their own for those who will take the trouble to read and understand them, for they are not light confections; the best of them are solid meat, food for mature intellects, and the concrete expressions of the real material advance of our civilization.

The other reason mentioned why there is not more research in textiles at the present time is the lack of single organizations of sufficient size properly to afford the large expenditures neces-

sary to a comprehensive and coordinated program of research. The nearest approach to such an organization in this country is the United States Institute for Textile Research. Properly supported it can fill a serious need. Fortunately there are researches of all sorts of magnitudes, and individual problems can be and often are split off for separate attack by relatively small groups. The really inclusive program, however, is very large. It involves a great deal of physical, organic and inorganic chemistry, the science of colloids, many branches of physics, a great deal of mechanics and optics, X-ray analysis, and several branches of biology. Much is accomplished at present by groups working in these various fields, in private, semi-private, and public laboratories and organizations, exchanging their views and results by means of publication in the various journals. There are single research groups involving workers of some different types, but none in this country involving all types. The large-sized private research laboratory, such as exists in the telephone field, in electrical manufacture, or in the manufacture of certain types of chemical products, does not exist in the textile field, and the results of a single-minded aggressive private attack on the general problems of textiles are hence absent. Its place is taken by various governmental, university, cooperative, and private enterprises which cannot, in the very nature of things, proceed as rapidly or as far. They are doing remarkable work, as some of the recorded results of this and other volumes testify, but there is a great deal that remains to be done. Their accomplishments prove that we can learn much and produce useful and desirable things even when the effort is somewhat scattered. There is no field in which there is a greater opportunity for accomplishment than that of textiles. The key to accomplishment is research. It need not be complex, in order to be useful, but it certainly should be intelligent.

Optical Measurement of Yarn Waviness as Distinct from Crimp

By E. R. SCHWARZ and G. H. HOTTE

Introduction

IN ORDER to demonstrate the difference between the waviness actually existing in the yarns composing a woven fabric and the values conventionally determined as crimp, six different types of fabric were tested warpwise for comparison by several methods, including microscopic analysis. Tests were made in triplicate and the averages are reported. The differences, taking into consideration the deviations in the data, are of real significance wherever so stated.

The fabrics may be rapidly identified as:

1—Medium belting canvas (cotton twill).
2—Cotton towelling.
3—Medium belting canvas (cotton twill).
4—No. 1 Cotton duck.
5— } All rayon—plain weave.
6— }

and will be denoted by number throughout this discussion. Their construction is shown in the photomicrographs of Figures 5 and 6.

Conclusions Summarized

It is concluded that:

(1) None of the mechanical methods of crimp measurement described give values which equal with even moderate consistency the results of the micro-examination.

(2) The micro-method is in the majority of cases far more rapid for the same precision, and capable of greater precision in a reasonable number of tests.

(3) Certain assumptions made in certain of the mechanical techniques are hardly justified.

(4) 'Waviness' as it exists in the yarn while in the fabric is given very closely by the micro-method, but differs significantly from 'crimp' as measured mechanically.

Waviness vs. Crimp

The recent development of optical equipment and techniques have made possible the direct examination of fabric structure and the measurement of such factors as crimp without the necessity for tedious and approximate methods. While Haven [1] states that 'crimp is generally defined as the percent deviation of the yarn as it lies in the fabric, from that in a straight condition,' it will be shown that this definition requires serious modification to allow the use of the tests proposed for the ordinary physical measurement of crimp.

Committee D–13 of the American Society for Testing Materials finds it needful to further define what is meant by 'straight' in the above definition, as the condition when the yarn is straightened but not stretched. This condition is determined as Haven [2] has outlined in his description of the preparation of a load-stretch diagram for the yarn removed from a fabric for test. The authors propose to show that 'crimp' as thus measured is not necessarily the same as the 'waviness' which exists in the fabric in its normal state. This difference has either been overlooked, or neglected because of the difficulty in measuring it without the aid of proper micro equipment.

The object of any of the mechanical tests thus far advocated is to obtain a length of yarn which has been straightened but not stretched. It is tacitly assumed that this length will be greater than the length of the yarn in the fabric by an amount equal to the crimp. This, of course will be the case when crimp is so defined. It is evident, however, that the value found will not necessarily be the waviness actually existing in the fabric. It is almost always less.

The Haven–Walen Method

In the technique advanced by Haven [3] the yarn is marked as it lies in the fabric, and is then ravelled from the goods, suspended parallel with a vertical scale, and the extensions produced by the addition first of a scale pan, and then of successive lengths of wire or small weights are measured by means of a light vernier attached to the yarn and read against the scale. It will be shown that the extra handling of the specimen and the method of such handling as employed in the foregoing method displaces the resultant diagram decidedly to the right on the extension axis, and changes it hardly at all along the load axis. The curve itself is substantially parallel with the curve resulting from a modified technique developed by the senior author just before microscopic equipment for the purpose of fabric analysis was perfected by him, several years ago. It is believed that several of the factors causing variation in results and difficulty in procedure have been eliminated by the newer technique. The results naturally will be lower than those obtained by the unmodified Haven-Walen method. While it is true that crimp obtained by this latter scheme approach more nearly to those given by the micro-method, they do not consistently equal these, and are not only more variable and less readily controlled, but also much more tedious in point of time and difficulty of manipulation.

The Improved Technique

For the sake of completeness the improved technique referred to above will be briefly described. In this method, the yarn is marked while in the fabric, the latter in the form of a strip about eighteen inches long by half an inch wide cut carefully from the goods. The upper gage mark should be about one inch from the end of this strip. The other gage mark is located just ten inches away, leaving six or seven inches of the strip at this end. The strip is then ravelled down until five or six yarns remain on each side of the center yarn which is to be tested. The cross yarns at the ends of the strip are then removed up to the gage marks, and the excess yarns on either side of the test yarn are cut across

at the gage marks. The fringes along either side of the strip are then trimmed off close to the outside yarns. There will then be a strip of fabric having the center yarn projecting about one inch from one end and about six inches from the other. The strip is then mounted in the crimp tester as in the older method, except that nothing is attached to it in the way of initial load. The lower end (six inches long) is tied or otherwise fastened to the last link at the free end of the chain of a chainomatic loading device (see Figure 1) so that the short loop of yarn hangs as

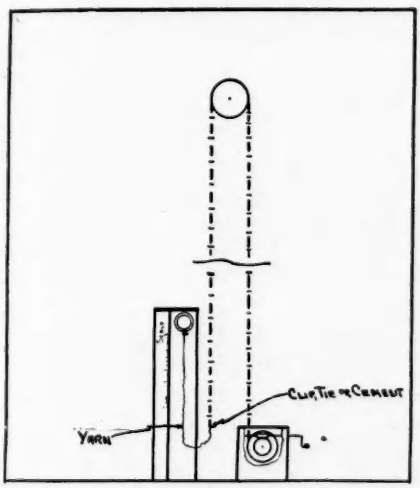

FIG. 1
CRIMP TESTER. CHAINOMATIC LOADING.
(Diagrammatic Sketch)

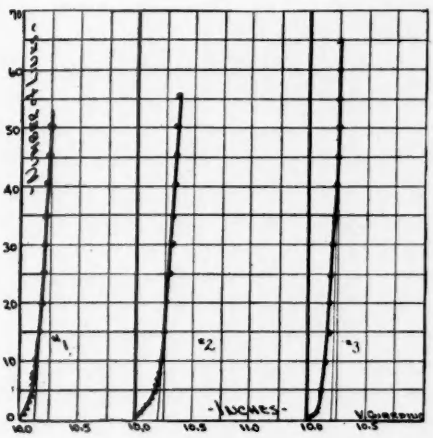

FIG. 2
CRIMP TESTS. CHAINOMATIC LOADING.
(Schwarz Preparatory Technique)

shown. The side yarns of the strip are now removed by carefully slipping them out one inch at a time, holding the fabric firmly at the point of removal to prevent distortion. There is finally left as the test specimen a length of yarn with a number of short lengths of cross yarns sticking to it (Figure 10), having as an initial load only the negligible weight of these (their removal causes more error than their neglect), the weight of the yarn itself (which cannot be eliminated), and half the weight of the short loop of yarn attached to the chain. Thus the dis-

tortion incident to the attachment of scale pan and vernier together with that incident to removal from the fabric are eliminated. A worm and wheel form a self locking and smooth working means for actuating the drum around which the chain (or a cord attached to it) is wound. The chain can then be lowered a fraction of a link at a time with no jar, with no chance of jerking the sample by the impact of the placing of a wire or weight, and with no chance for accidental spilling or slipping of weights. The chainomatic feature can well be driven by an electric motor connected to it through a reducing gear to provide extremely slow motion. Thus the rate of load application (a very important factor) can be governed. It is believed that this technique ensures a value of crimp closely in accordance with that defined as the straightened but unstretched length, when the resulting diagram is correctly interpreted.

Preparatory Methods Compared

No tests were conducted for the purpose of the present paper by means of the unmodified Haven technique, throughout. The

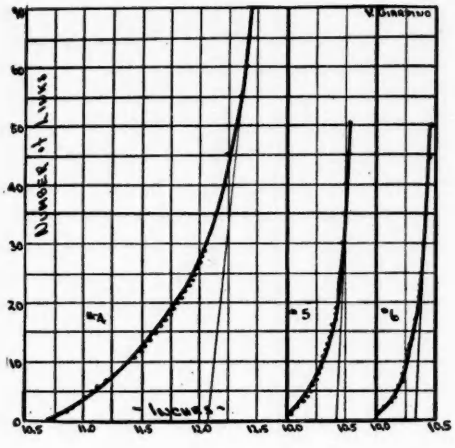

FIG. 3

CRIMP TESTS. CHAINOMATIC LOADING.
(Schwarz Preparatory Technique)

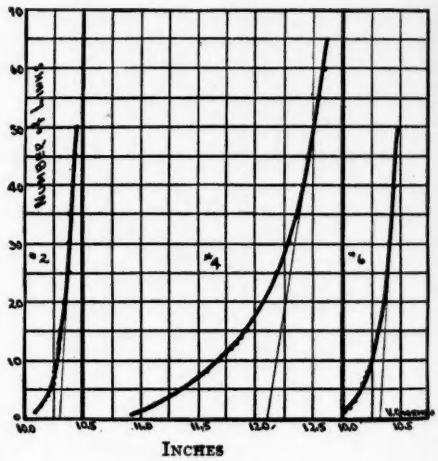

FIG. 4

CRIMP TESTS. CHAINOMATIC LOADING.
(Haven Preparatory Technique)

effect of the preparation of the sample, however was studied. The data will be found summarized in Table I and can be also

seen by comparing Figures 2, 3, and 4. Yarns for this test were removed from the fabric without being prepared in strip form, but were loaded chainomatically. The discrepancy would of course be greater had scale pan, weights and vernier been employed. Instead of the vernier, measurements were made without

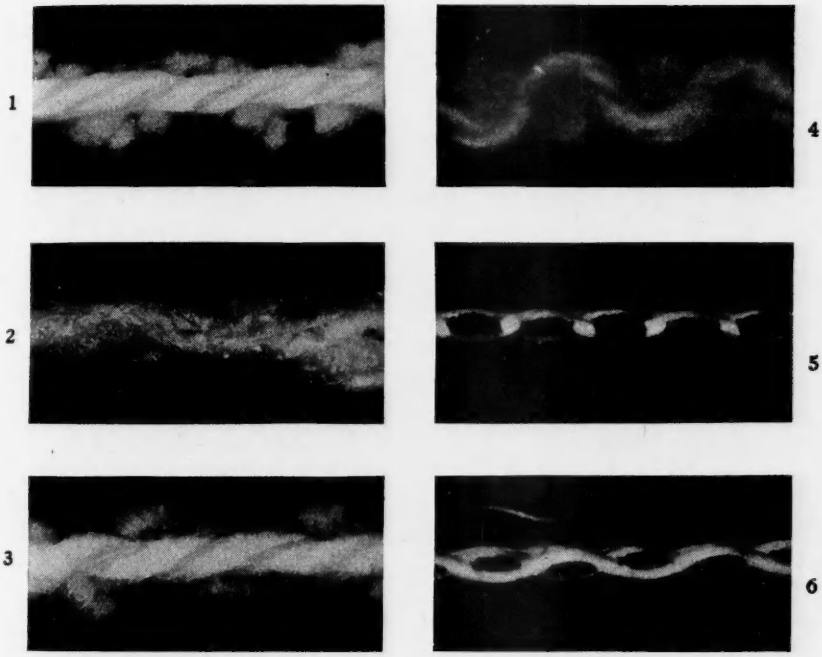

FIG. 5 FIG. 6

physical contact with the yarn by means of a spirit level, manipulated to eliminate parallax, and giving rapid and precise readings. A vernier attached to the scale and provided with cross hairs could be used to obtain finer divisions of the scale if desired. This extra refinement is hardly warranted by the precision of the data. A vernier adjusted to read to tenths of an inch would be very desirable, however. The values of crimp from the plotted data are determined by extending the straight portion of the plot (see following paragraphs for additional discussion of the curve) back to intersect the abscissa at zero load. If the difference measured in inches between this point and the origin be multiplied by ten, the result is evidently the percent crimp.

Further, if a vertical line is erected at this point on the abscissa and extended to intersect the curve, the ordinate of the point of

TABLE I

Sample Number	% Crimp		Dead Weight (no. of links)	
	Haven Preparatory Method	Schwarz Preparatory Method	Haven Preparatory Method	Schwarz Preparatory Method
2	2.8%	2.4%	13	16
4	21.6%	18.9%	26	25
6	3.2%	2.9%	17	15

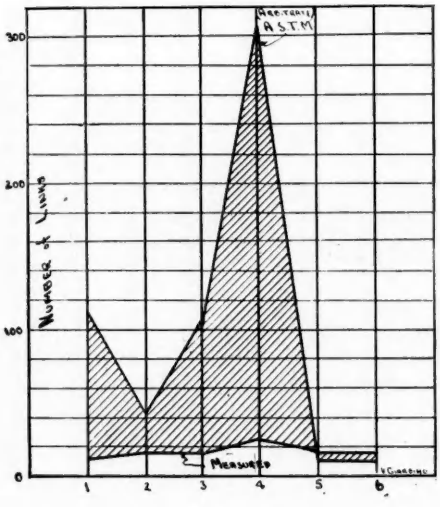

FIG. 7
SAMPLE NUMBER.

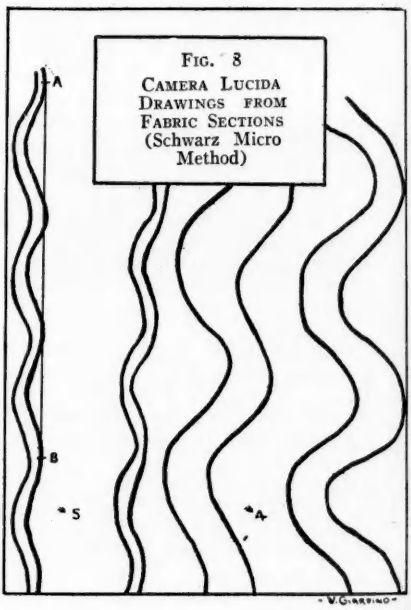

FIG. 8
CAMERA LUCIDA DRAWINGS FROM FABRIC SECTIONS (Schwarz Micro Method)

intersection will denote the approximate dead weight to be applied to this particular yarn in order to extend it a distance equal to the crimp. The use of such a load for subsequent tests

(assuming the same type of fabric made up of the same style of yarn) will render them more rapid and simpler in execution.

Reference to Figure 9 shows that this method (when the weight is allowed to remain in position for five minutes) produces results which are reasonably close to those obtained by the longer technique already outlined. An objection to the method

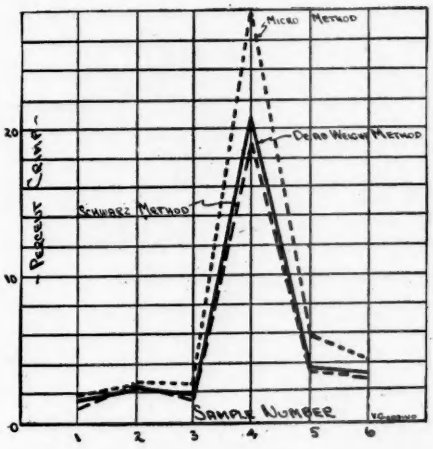

FIG. 9

lies in the necessity for use of the longer technique to determine the necessary dead weight for each new fabric or yarn. To assume, as the Committee D–13 of the A. S. T. M. apparently did in a recent specification,[6] that the dead weight of 75 grams which was found to be suitable for 11/23^s yarn from square woven tire fabric applied to other fabrics as well is hardly justified. Their recommendation that a dead weight can be determined by dividing a constant (which they state to be 156) by the counts of the yarn is shown by the result of tests on the six fabrics with which this paper deals to be without foundation. Figure 7 shows the results of the authors' tests. The equivalent single counts of yarn from each fabric were carefully determined. This value divided into 156 produces a weight which was converted to the equivalent number of links of the chain employed in the authors' tests. Application of this weight would obviously be futile since in many cases it far exceeds even the end

point values obtained by actual test, while in the remaining cases it is some 30% too low. Figure 7 gives a comparison of the actual number of chain links needed for the dead weight as determined from the plots of Figures 2 and 3 with the number of links called for by the A. S. T. M. formula. There would seem to be no logical reason why the dead weight to be applied should depend solely upon the counts of the yarn involved. Haven notes this fact.[5]

Interpretation of Crimp Diagrams

Plotting of the stretch-load curve resulting from the progressive loading of the yarn is conveniently done at intervals of one half link or suitable multiples thereof, since the weight of each link as it comes to a horizontal position is shared equally by the supporting chain and the yarn itself. The curve obtained is described by Haven [4] but certain of the terminology is either loosely used or not correct. The final portion of the curve cannot be considered as a 'region of perfect elasticity', simply because it is usually a straight line. Because the stretch varies uniformly with the load is no sign that the material being tested is necessarily perfectly elastic. It would be so only if it returned accurately to its original length after the removal (or repeated application and removal) of the load.

The diagram (see Figures 2, 3 and 4) represents only a small portion of the initial region of the complete load-elongation curve carried to the point of rupture. It is very doubtful whether any substantial portion of the complete curve can be termed elastic. Certainly that portion concerned with the straightening out of the yarn and the initial stages of fiber re-arrangement within the yarn structure cannot be so considered. In many cases, as Figure 10 (a photomicrograph of a portion of yarn No. 4, Figure 6) shows a yarn even at the end point of the crimp curve may still possess noticeable waviness. Until this is completely removed there can be no question of perfect elasticity even for a silk yarn composed of long filaments. The assumption is justified that the extrapolation of the straight portion of the plot back to meet the stretch axis indicates a point where the waviness has been partially removed but no stretch of the yarn structure itself has taken place. The result is 'crimp' however and

not 'waviness' as it exists in the fabric. A certain stress with resultant strain must be exerted on the yarn to overcome the more or less permanently set waves, and this is not included in the mechanical methods, and cannot conveniently be included. Ad-

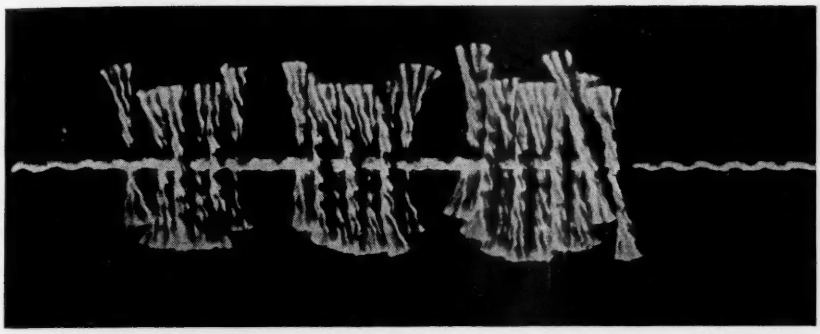

FIG. 10

"WAVINESS" REMAINING ON COMPLETION OF USUAL "CRIMP" TEST.

mittedly, then, these methods are approximations, and the real way to obtain the desired value is to measure it as it really is *in the fabric* with no unnecessary variables added.

TABLE II

Sample Number	Number of Links Required as Dead Wt. Found by Schwarz Preparatory Technique	% Crimp Found Using Dead Wt. Schwarz Preparatory Technique	% Crimp as Plotted Schwarz Preparatory Technique	% Crimp by Micro Method
1	11.5	1.5%	1.0%	1.9%
2	16.0	2.0%	2.4%	2.7%
3	15.0	1.7%	1.5%	2.7%
4	25.0	20.7%	18.9%	27.8%
5	15.5	3.6%	3.4%	6.0%
6	15.0	3.4%	2.9%	4.2%

Percentage of Waviness

The photographs of Figures 5 and 6 show cross sections of the six fabrics employed for this test, and indicate the ease with which the outlines of the wavy yarns may be traced. The pictures have lost considerable detail in the process of reproduction, but even in the form here presented they are evidence of the possibilities of the method. The preparation of the fabric sections is extremely simple and after very little practice can be made in a matter of less than five minutes. The fabric is cut into a small piece which can be placed flat on a cork surface directly below the objectives of a low power stereoscopic microscope. A *very sharp* safety razor blade in a suitable holder is used to make a clean cut immediately adjacent to and parallel with the yarn whose waviness is to be studied. The cut edge of the fabric is then mounted in a slit cut in a piece of cork, or otherwise held so as to be viewed at any desired power through the same or a regular compound microscope equipped with a camera lucida. The latter device enables the operator to draw in a traced outline of the curves of the yarn, as he sees them (eight such curves are shown in Figure 8). With a pair of dividers set close, the number of intervals along the curved line can be determined by 'stepping them off.' A straight line is then drawn tangent to the curves and between the same two points. The number of equal length intervals along this yarn is then counted. The difference between these two readings divided by the number of intervals in the straight line is the *percent waviness.* In one instance as for fabric No. 5 in the present tests, there were 27.7 intervals along the curve and 26.0 intervals along the straight line. The difference is 1.7 intervals, and 1.7 divided by 26.0 is equal to .064 or 6.4%. The determination including measurement and computation can be made easily in twenty minutes.

Advantages of Optical Method

With proper lighting the optical method can be used for even materials dyed black or dark shades, and obviously can be used in many cases where one section may give values for more than one set of yarns—as in double cloths, carpets, etc. In

certain few cases it may be slower than the mechanical methods —notably the dead weight method, but since these do not give the real 'waviness,' the extra time by the micro technique is justified. The waviness corresponding to 'take-up' as the weaver knows it may be found by dividing by the number of intervals in the curved line instead. When it is considered that a large number of sections at random points in the fabric can be prepared and sketched in a few minutes, it will be realized that the precision of the method can be almost anything within reason. The entire process (by actual timing) is from two to three times as fast as the mechanical techniques. From the standpoints of speed, ease, and precision everything is in favor of the optical method. When it is further considered that the waviness as it actually exists in the fabric is being measured with no ifs, ands or buts, it will be apparent that many of the sources of argument and difficulty inherent to the earlier methods are avoided. If it is also realized that the optical method provides for the measurement simultaneously of weave, sett, fabric thickness, yarn diameter, yarn density, etc., it would seem to be the rational procedure.

TABLE III

Sample Number	Weight of Five 10 Inch Singles of Warp (grains)	Counts	156 Divided by Counts Equals the Number of Grams to Apply as a Dead Weight	Grams Multiplied by 15.43 Equals the Number of Grains to Apply as Dead Weight	Grains Divided by the Weight of One Link (5.62 grn.) Equals No. of Total Links Required	Number of Links Required as Plotted by the Schwarz Preparatory Technique
1	3.02	3.84	40.70	628.0	111.8	11.5
2	1.14	10.30	15.40	233.9	41.6	16.0
3	2.83	4.02	38.80	598.0	106.5	15.0
4	8.29	1.40	111.50	1720.0	306.0	25.0
5	.28	41.40	3.77	58.3	10.4	15.5
6	.28	41.40	3.77	58.3	10.4	15.0

With the increasing use of optical equipment in mill, commercial, and educational laboratories devoted to textile research,

there should be increasing incentive toward utilizing optical procedures wherever they are found to be improvements over the older techniques; this particularly when more and more men trained in textile microscopy are becoming available to the industry.

References

[1] Haven, Geo. B. 'Mechanical Fabrics'—John Wiley and Sons, Inc.—New York, 1932—p. 322.
[2] Ibid, page 323.
[3] Ibid, page 324.
[4] Ibid, page 327.
[5] Ibid, page 328.
[6] A. S. T. M. Specifications, D39–27 (Revised 1927) paragraph 13.

"The only outstanding new textile products, and new uses for old products, developed during the last fifty years have been the direct or indirect fruit of fundamental research: Mercerized cotton; fast dyes, and synthetic fibres."—Scientific Textile Research.

"The day will come, and shortly, when, before granting a loan, the banker will insist on asking embarrassing questions regarding the research policy of his client."—From "Industrial Explorers," by Maurice Holland.

Economic Textile Research

Preliminary Report of Committee on Economic Research

THE COMMITTEE ON ECONOMIC RESEARCH submits to the United States Institute for Textile Research the following report on what the Committee conceives its functions to be, and places herewith before the Institute its recommendations for further action.

(1) The field of this Committee comprises in general the economic problems of textile production, distribution and consumption. These include problems for action by individual mills or by special industrial groups, problems which overlap more than one branch of the trade or more than one industry, and problems having to do with the social or economic background of the textile industry.

(2) It is the function of the Committee to suggest to the industry through the United States Institute for Textile Research those problems in the above field which seem to the Committee most deserving of research.

(3) It is, further, their function to suggest ways and means for the undertaking of research on the subjects suggested.

Basis of a Research Program

In accordance with the above the Committee recommends the following subjects as the basis of a program for economic research:

I. **Balancing and Stabilization of Production and Sales.** Case study of the best practice.

A clear understanding of the best practice in dealing with this matter is of vital importance to the industry, for it affects stability of prices, stability of employment, general financial

policies, etc. Such a study would involve consideration of possibility for forecasting demand through close cooperation with representatives of each of the chief factors in the channels of distribution from mill to consumer.

II. Selective Distribution.

This subject involves a study of the distribution of textiles through exclusive distributors, for a territory or class of trade or product. It should include a study of the types of product for which this form of distribution has proved most successful. It should also take into consideration the other conditions for success and the obligations undertaken by both parties to the arrangement.

III. Advertising and Branding of Textiles.

What, for example, are the types of products and types of distribution which best lend themselves to successful advertising and branding by mills? What are the trends in the use of private vs. mill brands? What is likely to be the effect of recent trends in marketing on advertising and branding?

IV. Pricing and Price Policies.

This study would involve such matters as quantity discounts, seasonal rebates, policies as to terms and cancellations, cooperative exchange of price information, differentials to different classes of trade. It would analyze existing practices and results and attempt to find the basis for a sounder policy than now exists.

V. Trends in Organization of Marketing by Mills.

Such a study would cover the important trends in marketing organization, including such matters as cooperative marketing of allied products.

VI. Vertical Consolidations and Results.

This would cover such matters as partial or complete control by mills of one or more of the steps in the channels of distribution between mill and consumer—for example, mill control of cutters or other outlets, or control by a rayon yarn producer of weaving, finishing, or converting outlets, etc.

VII. Horizontal Combination and Results.

A study of the effects of large combinations in the same field—both from a buyer's and seller's standpoint.

VIII. Channels of Distribution.

This would involve a statistical and case study to indicate the position and trend in the position of each of the important factors in distribution.

IX. Style Policies and Practices.

This would involve a study of the methods being used for measuring style trends, designing, checking the acceptance of styles, etc.

X. Color Principles and Practices.

This would cover such matters as practices in the standardization of colors, and the adaptation of the Munsell, or Ostwald, color analysis technique to textiles.

XI. Cost Methods in Production and Marketing.

This should include a consideration of best practices for figuring costs—marketing as well as production. It would presumably include studies of costs of selling to different types of customers and classes of trade and for different kinds of products.

XII. Studies of New Uses and New Markets for Different Kinds of Textile Products.

Subjects of Broader Scope

The remaining subjects are considered by the Committee to be important, but are listed at the end as being of a somewhat broader scope than the above:

XIII. What are the Trends in Textile Fibre Competition?

XIV. Inventory of Equipment and Production Potentialities for each Branch of the Textile Industry.

XV. What are the Scientific Bases for Plant or Product Expansion in the Textile Industry?

For instance, a thorough study might be undertaken of the various factors of consumer demand in their relation to plant

development in the textile industry. Specifically the following questions might give clues to valuable research:

(*a*) On what data have past expansion policies been based?
(*b*) How far has it been and can it be possible to gauge consumer demand?
(*c*) Can consumer tastes be forecast by statistical research?
(*d*) Could research in general business conditions such as is conducted by the American Telephone and Telegraph Company be applied with profit to the textile industry?

XVI. Relation of Textiles to General Business.

A survey of past history in the hope of drawing some conclusions as to the future.

Comments Requested

This list of 16 subjects is not considered by the Committee to be all-inclusive, but rather to be suggestive. Before undertaking to find ways and means for undertaking research on these subjects the Committee would like to obtain from members of the United States Institute for Textile Research, and from other interested factors in the trade:

1. An expression of opinion as to which of the above subjects are of the most interest.
2. What additional subjects—not comprehended in the above list—are considered of especial importance.
3. A list of such organizations or individuals as are known to have done or to be doing research on any of the subjects listed—together with a list of such reports or articles as may have already been written—which are considered to be of practical significance.

The Committee is already aware of important work that is being undertaken on some of the above subjects, particularly the valuable work that is being done with the support of the Textile Foundation. Many of these subjects have already been suggested to the Foundation as the basis of important research by one or more of the different branches of the industry. It is believed, however, that it will be of real service to the textile industry as a whole if a broad program of economic research

can be laid before the industry for their consideration and suggestions. Where parts of this program are well covered by research work already done or being done, naturally no effort at duplication will be made. Where problems are not well covered it will be the purpose of the Committee of the Institute for Textile Research to suggest ways and means for their coverage—once it has obtained an expression of opinion from the industry as requested above, and has obtained the required facts as to the present status of research on the subjects suggested.

SIGNED: Committee on Economic Research

H. V. R. Scheel, *Chairman*
Fessenden S. Blanchard
Paul T. Cherington
Evans Clark
Stanley B. Hunt
E. Kent Mitchel
A. W. Zelomek

"I am willing to interpret the handwriting which confronts our industry. It reads: 'The price of progress is research, which also assures the security of dividends.'"—Address of Arthur D. Little, "The Handwriting on the Wall."

Economic Research Report Attracts Constructive Comments

FROM those to whom the Committee on Economic Research referred their preliminary report, with the request for an expression of opinion as to which subjects are of most interest, etc., a large number of interesting and highly constructive comments have been received. A sufficient number of these to present a representative cross-section of opinion are reproduced herewith, and it is the hope of the Committee that their reading may stimulate others, who must be vitally interested in these subjects, to forward their opinions and suggestions.

If the number of people who have expressed already an interest in a particular subject is to be the basis for determining its importance, then the order of the subjects would be as follows:

First: Balancing and Stabilization of Production and Sales.

Second: Pricing and Price Policies.

Third: Cost Methods in Production and Marketing.

Fourth: Inventory of Equipment and Production Potentialities for each Branch of the Textile Industry.

Fifth: Channels of Distribution.

Style Policies and Practices.

What are the Trends in Textile Fibre Competition?

Vertical Consolidations and Results.

Sixth: What are the Scientific Bases for Plant or Product Expansion in the Textile Industry?

Horizontal Combination and Results.

Relation of Textiles to General Business.

Studies of New Uses and New Markets for Different Kinds of Textile Products.

Trends in Organization of Marketing by Mills.

Seventh: Selective Distribution.

Advertising and Branding of Textiles.

Color Principles and Practices.

LEAVELLE MCCAMPBELL, *McCampbell & Co., Inc.*

"I have your preliminary report on economic research for the textile industry, and I think this is very well gotten up. I do not know of anything that I can add, except that I consider the balancing of production and sales the most important subject you mention, and I am also very much interested in item XIV; that is, a proper inventory of equipment.

"We get a very good report monthly from the Government on spindles in place, spindles active, and spindle hours, but we do not get any data on loomage. With the advent of rayon, which accounts for the stoppage and demolition of a good many spindles, it is impossible to correctly interpret these figures unless we also have the loom figures to work from.

"We have had this up with the Bureau of Census, through the Cotton Textile Institute, but the Bureau claims that it will be quite expensive to give us the loom figures, and that their appropriation will not stand it. I do not see why this should be, because the mills are already making the spindle reports, and it would be comparatively simple to add a column or two of loom reports.

"If you are able to persuade them to get these figures up for us, and give them to us regularly, it would be most helpful."

ROBERT AMORY, *Treasurer, Nashua Mfg. Co., Inc.*

"Thank you for the copy of the preliminary report of the Committee on Economic Research. I have read it very carefully, and think very highly of it.

"You ask which problem strikes me as most important. I will state those which we would like to have answered first:

"4. *Pricing and Price Policies.*—This seems to be a matter, that, if clearly presented, would do more to obviate friction between buyers, distributors and sellers, than any other one matter. It is also a subject which can be well studied by all three parties, and might bring them closer together.

"11. *Cost Methods in Production and Marketing.*—This has great bearing on question 4, and insofar as it does, I would like to see this come next. A great deal has been done on mill costs which need not be duplicated."

S. R. GLASSFORD, *Bliss Fabyan & Co., Inc.*

"I have been greatly interested in studying over the advanced copy of the preliminary report on economic research which you sent me. In analyzing the various subjects submitted as a possible program for economic research, the conviction grew in my mind that the balancing and stabilization of production and sales held a place of importance almost, if not quite equal, to all the other subjects combined.

"As we look back over the last five to ten years our major troubles are found to emanate directly from the destruction of the balance between potential supply and real demand, probably made worse by ill advised attempts to cure the ills without getting anywhere near their root.

"I feel very strongly that if any means could be found to bring about the operation of the industry in terms of producing only that which could be profitably sold and consumed, instead of operating blindly with only continuous running, mass production and low costs as the object with sales and

consumption a secondary factor, many of the difficulties and questions would automatically pass from the picture.

"To a greater or less degree the questions of selective distribution, advertising, branding, pricing and price policies, organization and marketing, vertical consolidation, horizontal combinations, channels of distribution, and other subjects of lesser importance all trace back in their apparent necessity to the fact that the industry has insisted upon producing more goods than could be consumed at a profit to the producer. All these subjects have their place, but as I see it are wholly secondary to the major problem of the restoration of the balance between actual supply and real demand. By actual supply I mean the supply consciously planned to meet real demand based on intelligent judgment, and by real demand I mean demand for purposes of consumption rather than demand for purposes of speculation, in which latter case the process is merely one of change of ownership."

F. W. Binzen, *Mdse. Mgr., J. C. Penney Co., Inc.*

"We believe that an authoritative research on a few of these subjects would be of greater value than a cursory research on all of them. The two subjects that are of most interest to me are: No. 1, Balancing and Stabilization of Production and Sales; No. 8, Channels of Distribution."

George A. Sloan, *President, The Cotton-Textile Institute, Inc.*

"To my mind, one of the most important topics is your No. 1, 'Balancing and Stabilizing of Production and Sales.' Extensive research on this subject would clear the air of a good deal of vague thinking. Under this heading the possibility of forecasting demand in cooperation with channels of distribution is suggested. I imagine there are some people who believe that dependable forecasts can be made, but I feel the majority are impressed with the tremendous difficulties in so doing because of unforeseeable developments and because of the lack of success in forecasting heretofore. The leading economists of the country apparently are baffled in their efforts to prophesy business trends and their mistakes are common knowledge.

"As I look back over the evidence of fluctuating demand for textiles during the last several years, the difficulties in our own branch of the industry become apparent. I doubt whether anyone could have foreseen the tremendous demand that set in during the early part of 1929 or the sharp curtailment of demand that occurred in the fall of that year. Also, who could have foreseen, to the extent of regulating his production for several months beforehand, the very low state to which demand fell in the present year, or the lightning-like change that took place during the latter part of August. In general, it would seem that textile activity is inseparable from the drift of general business but yet there have been times such as in the latter part of 1926 and the early part of 1927, when cotton manufacturing, because of the extremely large crop with attendant low prices, and the absence of disturbing elements in general business, runs ahead of general business conditions. If it were possible to make a dependable forecast of demand for six months or so ahead that would be a

fine thing for the industry as it would enable the mill to follow a predetermined schedule of production and afford regular employment. Any failure of the forecasted demand to materialize would, however, be disastrous as mills would pile up stocks at relatively high prices which may have to be sold at a sacrifice or bear the expense of carrying.

"The alternative to dependence on a forecast of demand is to get along with a minimum volume of unsold goods and guide production schedules by the amount of orders received. This necessarily makes for irregularity in production, but at the same time it precludes the accumulation of heavy inventories and leaves the mill in a better bargaining position with the buyer. Of course, you will recognize the latter method of balancing production with demand as that which the Institute has advocated for several years.

"We have not, however, entirely overlooked the possibilities and advantages of attempts to forecast demand. Some textiles such as wide sheetings and towels lend themselves to estimates better than others. However, in fabrics subject to style changes, or dependent upon large industries that make frequent changes in the nature of fabrics used, such as possibly the automobile business, it would be more difficult than in wide sheetings to arrive at a worthwhile forecast.

"With our growing statistical background it should be increasingly advantageous to base production schedules on tentative forecasts combined with the policy of avoiding accumulation of stock. This, however, would not involve an out and out dependence upon estimated demand, but rather the employment of that procedure as an auxiliary to the practice of making goods principally on order. It would require a far closer organization of industry of the vertical nature than has ever been accomplished heretofore in order to otain material as a basis for a forecast from the retailers, wholesalers, cutters-up and converters. I won't say that it could not be done in time, but I see the difficulties clearly enough.

"I hesitate to say what I think are the most important subjects for study among those suggested by the Committee. The matter of consolidations is certainly of commanding interest. Some of the subjects you mention are having our close attention at the present time, including an inventory of equipment throughout the industry, a study of cost methods and new uses for cotton goods. We also make an annual study of the channels of distribution. Problems arising in connection with marketing of textiles should offer a fruitful field for research including 'Selective Distribution,' 'Advertising and Branding of Textiles,' 'Channels of Distribution,' 'Pricing and Price Policies' and others. Your Committee has evidently given a great deal of serious thought to the preparation of this report."

H. S. Davis, *Wool Section, University of Pennsylvania.*

"In examining the preliminary report on economic research for the textile industry, I have been struck by what seems to be a possible omission in the statement of the Committee's function. I refer to what it might do in the field of trade statistics. I wonder if the Committee and the Institute could not be of considerable service to the textile industry if they undertook in a general fashion to coordinate and stimulate statistical activities

now under way and to encourage further activities. Trade statistics in textiles, it seems to me, should be of such character as to give a complete picture of the flow of merchandise from raw material sources to consumers in each major textile industry and at the same time a picture of the changing competition among these industries.

"Perhaps this is only to be accomplished through the work of some general coordinating agency which will continually keep these ideas before those who are carrying on statistical work. In performing such a function a coordinating agency would doubtless find it worth while to call to the attention of the members of each industry the statistical work that was being done for them and how they might make use of it, and at the same time they might well point out to the various statistical workers how they could make their work more effective through improving manner of presentation, interpretation, etc. Moreover, the coordinating agency could well provide a 'form' for the interchange of experience among those engaged in statistical work in textiles in similar fashion to what Committee D–13 does for the textile engineers.

"I apologize for giving so much time to the question of trade statistics as a possible field for your Committee rather than commenting upon your program as outlined. I have done this, however, because I feel that much of the research which you suggest can only be adequately done when trade statistics in textiles have been considerably improved in the way of coverage, accuracy, etc. In regard to the program as outlined in the preliminary report, I sense a lack of some unifying purpose or plan. Some of the areas of studies suggested deal with general economic problems and others with specific questions of business technique. Perhaps it would be desirable to have studies dealing with both business techniques and general economic problems but I wonder if they could not be woven into some sort of a general plan or pattern. I presume that you have in mind the advantage, where possible, of making studies continuously in one field or area rather than isolated studies."

Prof. Edwin F. Gay, *Harvard University, Department of Economics.*

"I am greatly interested in the preliminary report of the Committee on Economic Research. I am not closely enough in touch with the textile industry at the present time to give advice as to which of the 16 topics will be of most practical value to the industry. To an economist, numbers 1, 4, 6, 7, 13, 14 and 15 seem of especial interest.

"The National Bureau of Economic Research is now sending to press a book on Seasonal Fluctuations, which brings out the importance of this factor. I notice that this subject is not included in your list. I should suppose that topics, such as an analysis of regional competition, and certain aspects of financing would be valuable. I suppose that a study of the most effective managerial policies would be rather out of your practicable approach."

Dr. Edmund P. Learned, *Harvard University, Graduate School of Business Administration.*

"I. *Balancing and Stabilization of Production and Sales.* I think a case study of the best practices on this subject would be worth while.

We have found, however, in our study that a large number of organizations know how to control inventories within limits. These may not be typical but their approaches and methods are worthy of detailed treatment. Probably more important than the methods is the conviction that balancing of production and sales is a paying policy. . . .

"II. *Selected Distribution.* To study selected distribution by itself seems to me to be questionable. Add to that title, an analysis of the position of the distributor by classes of goods and I could see much more in the subject. A number of people in the trade have wished to have a study of the place of wholesalers. I am inclined to favor a study of distribution by functions performed with the costs of performing these functions well established. I should wish to bring in to such a study the difficulties which a firm encounters when it attempts to use different channels of distribution at the same time. I think a case study or factual statement of the various ways in which companies have solved this problem would be instructive.

"III. *Advertising and Branding of Textiles.* The place of advertising and branding in textiles is worth studying at some time though I would not place it as early on the list. . . .

"IV. *Pricing and Price Policies.* I should recommend studying this rather early. All of the things that you mention would have their place, though I should emphasize at this time the cooperative exchange of price information and differentials to different classes of trade.

"V. *Trends in Organization of Marketing by Mills.* Our study would cover this subject sufficiently for the present.

"VI. *Vertical Consolidations and Results.* I am doubtful of the practical value of this study for the present. It would be necessary to gain full cooperation from all the vertical consolidations. . . .

"VII. *Horizontal Combinations and Results.* I should favor a study of horizontal combinations on the part of buyers and shall certainly recommend it. I am inclined to think that some advantage might come through horizontal combinations properly conceived. . . .

"VIII. *Channels of Distribution.* I believe this is a matter which should be undertaken. It ties in with some of the earlier questions of costs of distribution as well. I think this topic ought to be broadened so that really fundamental information on demand could be established. I am thinking of the possibility of economic planning within the cotton textile industry. It is through the cooperation with channels of distribution that we may be able to get information along these lines. . . .

"IX. *Style Policies and Practices.* Since the silk industry is included in the work of this organization, I should say that a study of style policies and practices would be desirable. I think case studies are one possibility; descriptive material also is worth while. . . .

"XI. *Cost Methods.* This is a topic which should be carried much further than it has been to date. Costs of selling different types of customers certainly should be brought in here if not under one of the other heads; and there is considerable room still for improvement in manufacturing methods. . . .

"XII. *Studies of New Uses and New Markets.* I think the industry can well afford to have some organization devote its attention aggressively to the problem of new uses and new markets and to the maintenance of existing frontiers. Some companies should do individual research along

this line but unquestionably there is some research which is of a general nature. . . .

"XIV. *Inventory of Equipment and Production Potentialities for each branch of the textile industry.* I think a complete inventory of equipment and facilities for each branch should be prepared promptly. This is one of the steps in economic planning. I wish it were possible to go still further and by comparable methods have the relative efficiency of various units determined. This, of course, would mean their cost of production. Any economic policy adopted by the industry which is designed to keep in existence the economic unfit, that is the high cost producers, seems to me to be anti-social and to be discouraged. The industry should face this fact, and if it were possible for any central agency to get the true facts, then mergers might proceed upon a sound basis. I feel that some mergers probably are desirable but adequate data to consummate them are not available. This sort of material would be a background to answer your heading XV on the Scientific Bases for Plant or Production Expansion. A few companies make careful market analyses including a statement of existing capacity and potential competition, the size of the domestic market, and whether it is growing before they consider any possible expansion in a new direction. One company that I know about did not enter a certain branch of the cotton textile business as the result of such an analysis. Another company which has expanded has used a similar type of analysis as a basis for its expansion. I think in both cases the decisions were correct."

George W. Taylor, *University of Pennsylvania.*

"The report has, in my opinion, pointed out a number of significant fields of research that should provide good yields for the industry in their working. However, as a personal reaction, I think I would like to have seen such a broad program of economic research based upon some unifying concept. It appears that the list of sixteen subjects, each in an isolated setting, makes it somewhat difficult to call the report a program. To be more specific, is the program particularly directed toward economic stabilization projects, are its studies to be concerned with aids to intra-plant operation, or is it to consider particular economic problems in specialized fields? For instance, if the latter is the purpose of the study, an inclusive program would include not only the suggested selective distribution, but also what might be termed selective financing, methods of production, etc.

"Some of the suggested problems, such as No. III, 'Advertising and Branding of Textiles,' No. IX, 'Style Policies and Practices,' and No. X, 'Color Principles and Practices,' may be tasks for the operating specialist rather than being related to general economic research. It is therefore my personal reaction that there should be a differentiation of the general economic research projects from those involving tasks for the specialist in certain business technique. Perhaps it is this that made it appear to me that the report lacked a clear statement of the underlying purpose of the research projects.

"Would it be at all possible to consider what would constitute a well rounded research program in the three major fields of production, distribution, and consumption, differentiating between the general economic research and the specialized research in the techniques of each field? With

this as a basis, it would be possible to indicate those fields in which research efforts have been or are being made. This will throw into bold relief the gaps in the existing work that prevents it from being a well rounded program. There seems to me to be a real need for a clearing for the textile research projects that are under way, as well as for the results that are achieved. With this clearing and with a comprehensive program devised, it seems that your committee could do a much needed job along the lines of your third mentioned function of 'suggesting' ways and means for the undertaking of research on the subjects suggested.

"There seems to be no question whatever about the necessity for many of the projects mentioned in your report. No doubt it is the intention to pursue studies along these lines in detailed fields of industry. For instance, it would be inconceivable that color principles and practices could be studied except in relation to numerous textile industries.

"It was a privilege to have the opportunity of looking over your report before its public release, and I am sure that it will receive general approval."

Mr. Thomas B. Hill, *President, C. K. Eagle & Co., Inc.*

"Of the sixteen items listed, it is my opinion that Item No. 1 'Balancing and Stabilization of Production and Sales' is the most vital and important subject set up on the program for immediate consideration. Obviously, this is a broad subject but just as important to the vital interests of industry, business and the consuming public to be accomplished as any matter I can think of. Many of the ills of our economic system are tied up in the solution of preventing over-production or untimely production, as compared with either sales or consumption. If at first the Committee can ascertain the causes of over-production, which to my knowledge have not been set forth in a concrete and intelligent manner up until this time, I think there is a strong possibility that the leadership of industry can find a solution to the problem.

"I think the other items in this list that are next in importance are as follows: Nos. 4, 5, 6, 7, 8, 9, 11 and 14.

"All other items not mentioned above in the calendar of the sixteen items that have been set forth, are somewhat important for research, but I feel those that I have enumerated are more vital to the best interests of all concerned.

"May I suggest two other subjects that I believe are worthy of consideration of the Committee for research:

"1. *Trade Ethics.*—In connection with this subject, I have a full appreciation that it is very difficult to uncover fully the many desirable and destructive practices in connection with the intra-trade commerce; nevertheless I believe that the standards are being lowered progressively from what might be termed the necessary reasonable plane of ethics.

"2. *Elimination of Waste in Industry and Business.*—This is a tremendously broad subject for research but I believe in all elements of the economic structure, production and distribution that there is much that can be accomplished if a comprehensive analysis were made of the major items of waste."

Mr. Eugene Szepesi, *Consulting Management Engineer.*

"I am of the opinion that there is a crying need for some means through which the various manufacturing branches could, directly and timely enough, obtain the causes of unfavorable reception, or change of favor, with the ultimate consumer. The department stores would be in an excellent position to explain, through their statistical accumulations, many sudden changes in public favor for certain textile products, with definite reasons, which information, if received by the producers timely enough, would still create the opportunity to alter a product before it has been entirely eliminated from the market. I have in mind many products which deserve a better fate, which lost their market on account of some slight deficiency, and which could have been readily improved."

Mr. Weston Howland, *President, Warwick Mills.*

"Balancing and stabilization of production and sales seems to me to be the important subject among the sixteen listed for study.

"My inclination would be to put the energy and expense into this subject. If it could be solved, it would be the answer to all our problems. For the moment, the others could well follow after."

Mr. P. A. Johnson, *Pres. and Treas., The Aspinook Company.*

"Of the sixteen subjects listed, I would select as the most important —No. XI—'COST METHODS IN PRODUCTION AND MARKETING.' I feel that a uniform cost system which would reduce costs to a common denominator, so that comparisons could be made among competitors on an intelligent basis, would be one of the most effective means of eliminating blind and ruthless competition which has been the ruination of many textile plants during the past few years.

"I would also suggest as a subject for research—TRADE ASSOCIATIONS—THEIR EFFECTIVENESS AND LIMITATION AS APPLIED TO TEXTILE FABRICS."

Mr. Sidney S. Paine, *Pres., The Textile Development Co.*

"Replying to your letter of August 10th enclosing the preliminary report on Economic Research for textile industries, I would say that I feel that subjects No. 1 and No. 4 are the most important.

"I wish it were possible for the Institute to study the question of whether cooperation is possible within the cotton industry, or whether it is a glorious pipe dream and we have got to come out frankly and say that the situation is one of 'dog eat dog.' A step further, in case it is found that cooperation is not possible, is some method of coercion for regulation possible? This seems to be a rather general statement, but I think the lack of cooperation has been one of the large elements in making the depression hurt more than is necessary."

MR. WARREN E. EMLEY, *Chief, Organic and Fibrous Materials Div., Bureau of Standards.*

"To my mind the most important economic problem for the textile industry to solve is to find some way whereby contact may be established directly between the manufacturer and the ultimate consumer. I believe that if the manufacturer could have the benefit of the direct criticisms of his product from the consumer, it would help him in planning his work, and that if the consumer could have the benefit of direct information about manufacturing difficulties, some of the present consumer demands would be put on the more rational basis.

"The problem on the list which comes nearest to this is No. 6 on vertical consolidations. This might incidently be expanded to include other types of vertical consolidations where the textile mill is owned by the retail store."

"Eternal research is the price of survival in modern industry. No investor or banker can feel sure that his interest in any security is secure in the absence of the assurance given by the knowledge that science is on guard."—From "What Price Progress," by Hugh Farrell.

"Thou shalt compete in creativeness, rather than on price alone, for research is today the gateway to survival and leadership."—From Henry P. Kendall's "Ten Commandments for the Textile Industry."

Research News

PROF. GEORGE B. HAVEN, member of U. S. Institute's research committee, director of the textile laboratories of Massachusetts Institute of Technology, and author of Mechanical Fabrics, was the recipient, Sept. 29th, of the medal of the National Association of Cotton Manufacturers, "for his many years of accomplishment in furthering the knowledge of the properties of the cotton fibre, yarns and cloths, through the application of research, and in recognition of his pre-eminence as an educator and scientist in the field of cotton textiles." The presentation was by Franklin W. Hobbs, chairman of The Textile Foundation and a former president of the National Association of Cotton Manufacturers.

Isoelectric Point of Silk

STUDIES conducted at the Bureau of Standards by Milton Harris, research associate of the American Association of Textile Chemists and Colorists, have defined the isoelectric point of silk at pH 2.5. A colloidal, or other, particle is said to be at its isoelectric point when the particle is electrically neutral with respect to its surrounding medium, and this point is usually defined as the pH of the medium. For an amphoteric substance the acidic and basic ionization are equal at this point. In this case, when the electrophoretic velocity of the suspended particles and of the dissolved silk absorbed on quartz were measured, the pH at which no movement occurred was found to be 2.5.

The low isoelectric point of silk shows it to be one of the most acid proteins known. This accounts for its pronounced affinity for basic dyestuffs. The results obtained also show that the basic properties are less pronounced than those of most proteins. Consequently workers who have used less sensitive methods have obtained wide isoelectric ranges.

The Isoelectric Point of Silk.—Milton Harris, *Am. Dye Rptr.*, 1932, Vol. XXI, No. 21, p. 604–5.

Anti-Crease Cottons and Rayons

THE advantages and sales possibilities of cottons and other textiles that could be processed to prevent their creasing or wrinkling, have been appreciated, and now, thanks to scientific research, such a process has been perfected. It is the result of studies conducted in the laboratory of Tootal, Broadhurst, Lee Co., Ltd., one of the largest cotton manufacturers of Manchester, Eng. Mr. Kenneth Lee of this company for years has been a leading advocate of fundamental research.

"Yarns and fabrics of various textile fibres," says the Textile Mercury, "may be made uncrushable by impregnating them with a synthetic resin so that this is mainly distributed within the individual fibres. The resin must not be without the individual fibres as in the case of a size since this has the opposite effect and makes the textile material stiff and even more crushable. Presumably the pores of the fibres are filled up with the synthetic resin and this gives them a spring elastic character which characterises real silk and wool and which is highly desirable in cotton. A wide range of synthetic resins may be made by condensing formaldehyde with various organic substances, mainly, but not necessarily, those containing hydroxyl groups such as phenol, glycerine, urea, etc."

The technical explanation is that cotton and other textile fibres "are rendered creaseless by effecting the final condensation or polymerization of a synthetic resin in presence of the textile material."

The Sayles Finishing Plants, Inc., and the Pacific Mills have been licensed in this country to produce creaseproof fabrics by this process.

Methods of rendering cottons uncrushable were reprinted from Textile Mercury in the September Bulletin of the National Association of Cotton Manufacturers.

New Method of Analyzing Weighted Silk

A NEW method of determining the weighting in silk goods has been developed by the Bureau of Standards, Washington, D. C., which is described as generally applicable, rapid and convenient.

By this method of analyzing weighted silk, weighting and finishing materials are removed by repeated extractions first with hot water, then with a 2 per cent solution of sodium carbonate, and finally with a solution containing 2 per cent of hydrochloric and 2 per cent of hydrofluoric acids. Results of analyses of samples of known composition are presented which indicate that the results are correct to within 1 per cent of the weight of the dried finished material.

Results obtained by inexperienced analyists, working in different laboratories, have been in good agreement when samples of the same silk were analyzed. Qualitative methods for the identification of the following weighting materials are given: Alumnium, lead, phosphate, silica, tin and sinc.

Economic Study of Upholstery Industry

AN analysis of the upholstery weaving industry, with particular relation to competition between Philadelphia and southern mills, has been reported in Study No. 20 of the Industrial Research Department of the University of Pennsylvania. It is asserted in the report that mills in North Carolina can make tapestries for approximately one-fifth less than mills in Philadelphia.

Chapter headings include: The Wage Dispute of 1930–1931, History and Economic Characteristics of the Industry, Collective Bargaining, Earning and Working Opportunity; Production, Marketing and Financial Data. In conclusion, definite recommendations, covering "The Central Problem," "Labor Policies," "Designing and Selling," are offered for consideration, which are of extreme importance to everyone associated with the industry.

Abstracts and Bibliography

This section is compiled under the direction of the Committee on Abstracts and Bibliography: Prof. E. R. Schwarz, Chairman, Dr. W. E. Emley, Mr. E. D. Walen, Prof. Louis A. Olney.

The Arrangement

Abstracts and Bibliography are arranged alphabetically by major subject under the following classifications:

I. Fibres (Synthetic and Natural) and Fibre Analysis.

II. Yarns and Fabrics.

III. Chemical and Other Processing (Not Otherwise Classified).

IV. Research Methods and Apparatus.

V. Economic Research and Miscellany.

Subjects are followed by name of author, and the abbreviated or complete title of the publication is followed by the year, volume, issue number or date, and the page number or numbers.

A list, with abbreviations, of publications regularly abstracted will be found at the end of this section. It will not be published again in this volume, therefore should be preserved.

Abstracts

I. Fibres (Synthetic and Natural) and Fibre Analysis

Adsorption of Water by Rayon. Alex. R. Urquhart and Norman Eckersall. *J. T. I.*, Aug., 1932, P. T163.

An authors' summary states that the present paper describes the application of the methods previously developed for cotton to the determination of the regain-relative humidity curves for a series of rayons, most of them being in the form in which they are, or were, commercially obtainable. The results are of interest principally as data for reference purposes, and the general conclusions are for the most part in agreement with those of the earlier workers. (S)

Bacteriology of Wool: A Contribution to the. Arthur L. Smith. *Am. Dye. Rptr.*, Aug. 15, 1932, P. 501.

An editorial abstract states: "There are two general methods of scouring wool: namely, by solvents, and by soap and soda ash. In the solvent scour there is little reason to consider bacterial action. In the soap and soda ash scour the liquors contain many bacteria of various kinds. When allowed to remain in the finished product some bacteria may cause serious damage by weakening and embrittling the wool and by causing white spots in the dyed product. Since a knowledge of these bacteria and their reactions might prove of value in combating them, and since they might conceivably come from the scouring process, it was decided to try to determine the species present in the scouring liquors." (S)

Chemistry of Cellulose: Modern Developments in. II. Fundamental Constants and Physical Properties. S. M. Neale. *Rayon Record*, 1931, 5, 584–5; cf. C. A., 25, 5554.

A review of recent work (with five references) upon the physical properties of cellulose and rayons, including the specific volume, refractive index and electrical conductivity. (Copied complete from *Chem. Abs.*, 1932, 26, 3115.) (W)

Cortical Cells of Merino, Romney and Lincoln Wools. M. T. Gabriel. *J. T. I.*, Aug., 1932, P. T171.

A new method has been used for breaking up wool fibres for the study of their cellular characters. Measurements have been made of the length of the cortical cells in wools of different origin and breed and of very different fibre thicknesses, and the cells examined generally for any notable differences. Great differences have not been found, and the cortical cells of extremely fine Australian merino fibres were remarkably similar to those of the coarse Lincoln fibres. The slight differences that did occur in average length, variation from the average, and in general appearance are noted. This is the use of the method mentioned in a previous abstract (see *T. R. I. Bulletin*, Vol. II, No. 7, P. 10) involving treatment with a bacterial culture. (S)

DAMAGE IN WOOL: DETECTION OF: WITH INDIGO CARMINE. A. Herzog. *Mell. Textilber.*, 1931, 12, 768–9.

The mechanically and chemically (e.g., with NaOH) damaged portions of wool fibres become stained deeply when treated with aq. indigo carmine, and this staining is more clearly observed microscopically if the fibres are mounted in glycerol. (W)

WOOL: CHEMICAL AFFINITIES OF. M. J. Rouffin. Rev. gen. mat. color, 1932, 36, 140–143.

Wool shows a selective absorption tendency for acids and alkalies. Partition reaches an equilibrium which is dependent on the nature of the acid, the temperature, or the presence of dissolved substances. A method is described for measuring the distribution of sulfuric acid between water and wool in boiling water. A table is given for estimating the acidity of a wool sample by boiling 10 grams in 500 cc. of distilled water and titrating a 250 cc. sample. There is a brief discussion of the effect of this acid distribution on dyeing operations. (W)

WOOL: RESEARCH IN. S. G. Barker. *Tex. Am.*, Aug., 1932, P. 50.

A lecture reprinted from the *Hosiery Trade Journal* which reviews work done by the staff of the Wool Research Association. The matter treated is concerned largely with practical results of research on felting, finishing, bleaching, the handling of yarns, and knit goods. (S)

WOOL: THE UTILIZATION OF. S. G. Barker, *Tex. Am.*, July, 1932, P. 13.

An article reprinted from *The Quaker Ram* which reviews the subject of wool utilization from the standpoint of the farmer, the manufacturer, and the consumer. Several of the interesting new machine developments are outlined together with a summation of eleven special virtues of wool. The article concludes with a brief review of some of the fundamental research done by the British Wool Industries Research Association. (S)

WOOL QUALITY AND SPINNING PROPERTY. J. Lyntol. *Tex. Am.*, Sept., 1932, P. 45.

In this article some of the many factors modifying or enhancing the spinning property of wool have been referred to, and these illustrate the fact that the quality numbers given to wools in raw or semi-manufactured state, while bearing some relationship to actual spinning values, do not and cannot indicate exactly the length of yarn per pound to be obtained from any material. (S)

X-RAY DIFFRACTION PHOTOGRAPHS OF FIBRES. W. T. Astbury. *Tex., Mfr.*, Aug., 1932, P. 323–325.

A recent lecture to the Photographic Society and first printed in the *Photographic Journal.* Ten excellent X-ray pictures are given together with several descriptive diagrams, and the paper represents a review of current work in this field which should be of considerable immediate interest. (S)

II. Yarns and Fabrics

Cotton Yarn: the Shrinkage of: and the Viscosity of its Solutions in Aqueous Caustic Soda—Cuprammonium Hydroxide. S. M. Neale and W. A. Stringfellow. *J. T. I.*, Aug., 1932, P. T177.

The shrinkage of cotton yarn in mixed solutions of sodium hydroxide and cuprammonium hydroxide shows a maximum value at concentrations of sodium hydroxide between 0.1 N and 0.3 N. This maximum becomes very sharp and pronounced for concentrations of cuprammonium hydroxide within the range 0.05 to 0.1 N. Solutions obtained by dissolving the cotton yarn in sodium hydroxide-cuprammonium mixtures containing a still higher proportion of the latter constituent show no marked change in viscosity over the range of sodium hydroxide concentrations in which the observed variations in shrinkage occur. (S)

Cotton Yarn Defects. Albert D. Barnard. *Tex. Wld.*, 1932, Vol. 82, No. 3, P. 84–5.

The author holds that "with good quality warp and filling, modern automatic looms should operate at near 100% efficiency, or run about 9.9 hours out of every 10 hour period." To make this possible yarn defects that retard production must be eliminated. Causes of such defects are noted and means for their prevention indicated. (C)

Oil Stains. II. H. R. Hirst. *J. Soc. Dyers & Col.*, 1932, 48, 90: cf. C. A., 26, 2323.

The tendency of fatty oils permanently to stain wool through ageing can be determined by spotting the fabrics with the oil under examination and exposing the treated fabric to the Fadeometer for varying time intervals. Subsequently the fabric is scoured, washed and dyed with Fast and Blue RH in acetic acid solution. The minimum time exposure to the Fadeometer required to develop oil stains after dyeing is the end point. (W)

Oxy- and Hydro-Celluloses: Test for Distinguishing. R. Haller. *Mell. Textilber.*, 1931, 12, 257; cf. C. A., 26, 296.

Cotton fabric freed from impurities is immersed for one to two hours in cold aqueous stannous chloride, washed and immersed in a solution of one or two drops of gold chloride per liter of water; the presence of oxycellulose is indicated by development of a purple color, whereas hydrocellulose produces no distinctive coloration. The test is effective even when the cotton has been previously boiled with NaOH. A technically bleached fabric usually gives a pink color in the above test. (Copied complete from *Chem. Abs.*, 1932, 26, 3661.) (W)

Rayon Yarns and Fabrics Through the Microscope. E. R. Schwarz. *Mell. Tex. Mo.*, Sept., 1932, P. 387.

The first part of an article concerned with the microscopic examination of rayon materials reviewing practical applications of micro-research in this field. Numerous photomicrographs are used for illustration. (S)

TWISTING AND UNTWISTING SINGLE AND FOLDED YARNS: A MACHINE FOR INVESTIGATION OF DEFECTS. E. J. Poole. *J. T. I.*, July, 1932, P. T150.

The author's summary states: "That the machine or apparatus, which is a compound differential mechanism, has been designed with the intention of producing a means whereby any plied yarn may be divided into its component singles. It had long since been found desirable to have such a machine in order to obtain more reliable data with respect to the single yarns which are of more particular concern in certain technical investigations than the plied yarn.

"The usual procedure has been to untwist as long a length of yarn as possible by means of two twist testers and wind the singles on to bobbins. This method is far from being satisfactory although with exceptional care a fairly reliable result may be obtained, yet the whole is subject to personal error. By such a mechanical contrivance, as is illustrated and described, it is possible to obtain the component singles from practically any length of folded yarn and submit the same to any test desired." (S)

WORSTED YARNS: LEVELNESS OF. P. R. Stanbury. *Tex. Mfr.*, June, 1932, P. 219.

The author states that "The weight-per-unit-length method of measuring regularity, while excellent for roving of low twist, is hardly sufficient in itself for yarns, although giving valuable information. Measurement of twist," he states, "is one of the least satisfactory methods for measuring yarn levelness, because of the great variation due to reverse twisting and other items familiar to all users of plied and single yarns. Not only is this the case but the method of measuring the twist may be open to serious question." The author concludes that the measurement of yarn thickness is one of the most satisfactory means for getting the levelness of worsted yarns. He mentions a visual method of measuring yarn against a background of contrasting color very much like the evenness board for silk. Further, he discusses Frenzel's method for the design of an instrument for the continuous recording of yarn diameter. This is done by means of a small feeler resting lightly on the yarn as it is wound on a drum. The British cotton research association has also devised a method in which Oxley uses a visual diameter obtained by drawing yarns through a pair of metal shoes. The electrical capacity method is also mentioned but only very briefly, and finally the so-called WRIA photo-electric method is noted. Here a shadow is passed by a short length of yarn and affects the amount of light falling on a photo-electric cell. Similar tests have been reported in the Journal of the Textile Institute from the wool research association. Another method is that employing a thermo-electric couple so as to intercept radiant heat passing by the yarn. A last method is that of diffraction and describes a modification of the method proposed by Young and further developed by other writers.

If a numerical estimate of the degree of irregularity is required, the method usually adopted is to measure the total area between a curve representing the data and the base line by means of a planimeter and then to divide this by the length of the record. For weight per unit length measurement the most convenient method is said to be calculation of the coefficient of variation. (S)

III. Chemical and Other Processing (Not Otherwise Classified)

Cotton: The Moisture Relations of. VIII. The Effect of Processing. Alex. R. Urquhart, William Bostock and Norman Eckersall. *J. T. I.*, July, 1932, P. T135.

This is the eighth of a series of papers on this subject, and the authors' summary states that the effect of the time and temperature of drying on the subsequent picking up of water has also been examined, and it has been found that the hygroscopicity decreases slightly but steadily as the duration and temperature of drying are increased. If a damp sample is treated for a short time at not too high a temperature, however, its subsequent hygroscopicity may be slightly greater than that of the untreated sample.

The effect of the initial air-drying of a mercerised cotton has been examined in greater detail than hitherto, and it is shown that the very great adsorptive capacity possessed immediately after the mercerisation process is impaired continuously as the material is dried down the primary desorption curve.

Finally, some figures are given for a few oxy- and hydro-celluloses, which show that chemical attack is so serious as to cause almost complete loss of strength. (S)

Fastness to Light of Colored Material. P. W. Cunliffe. *World's Paper Trade Review*, 1932, 97, 843–7; cf. C. A., 26, 2601.

A discussion of the eight principal factors affecting the fading of dyes by light; quality and intensity of light, relative humidity of the atmosphere, temperature, depth of color, acidity or alkalinity of the support, atmospheric impurities, nature of support, and continuous or intermittent exposure. (Copied complete from *Chem. Abs.*, 1932, 26, 3115.) (W)

Metallic Catalysts: Effect of; In Bleaching of Knitted Woolen Goods with Hydrogen Peroxide. S. R. Trotman and G. N. Gee. *J. Soc. Dyers & Col.*, XLVIII, No. 8, P. 229.

The effect of iron, copper, manganese, cobalt and silver in small amounts acting as catalyzers in the decomposition of hydrogen peroxide solution made alkaline (*a*) with ammonia and (*b*) with sodium silicate is experimentally shown under various conditions, as pH of the bleaching bath, the presence of the catalyzer in the peroxide solution, its presence distributed throughout the goods to be bleached and also when present in spots on the goods. It is shown that catalysts cause a much greater loss of peroxide strength in the presence of ammonia than silicate of soda. However, when the catalyst is present in a comparatively large amount, copper and iron have a greater tendering action on the goods in the presence of sodium silicate than in the presence of ammonia at pH 10. The destructive action of the alkali solution is confined to the cortex of the wool fibre and is intensified by the hydrogen peroxide in the presence of the catalyst. Copper apparently causes the greatest tendering action, and when present in spots causes the wool to dissolve completely, while iron produces a distinctly tender spot.

Experiments indicate that in the presence of small quantities of metals, a better bleached white is obtained by raising the pH of the bleaching bath

with sodium silicate. Information is given regarding the proper pH for bleaching chlorinated wool, with a consideration of the structural damage due to chlorination. The authors' useful method for using the biuret reaction in determining the loss in weight of wool during bleaching is described. (D)

MILDEW: THE CHEMISTRY OF. A. A. Cook. *Am. Silk & Rayon Jnl.*, 1932, Aug., P. 34; Sept., P. 34; Oct., P. 35.

A series of three articles, the first of which outlined the various environmental factors as they affected the growth of fungi. The second deals briefly with the physical and chemical changes which take place together with methods for detection and estimation of damage. Vegetable, synthetic and animal fibres are considered separately. The third article is largely concerned with prevention of mildew and consideration of numerous disinfectants. Several references and patents are cited. (S)

MILDEW IN SIZING AND FINISHING: PREVENTING. Karl M. Herstein, F. A I. C. *Tex. Wld.*, July, 1932, P. 78–9.

Briefly describes the causable agents in mildewing of textiles, their growth or action and their effect. Noting that mildews will not grow on properly poisoned material he lists the following antiseptic substances as the most important: chloride of zinc, sulphate of zinc, salicyclic acid, carbolic acid, cresylic acid, formaldehyde, thymol, etc. The guiding principles to be used in selecting a mildew-proofing agent as laid down by the British Cotton Industry Research Association, and as cited by Killheffer (*Am. Dye. Rptr.*, XVII, 14, 256), are tabulated. Among compounds that combine the necessary antiseptic qualities with other useful chemical functions are the following: naphthalene isopropyl sulphonic acid sodium salt, and mixtures containing this compound which are sold under various trade names as a penetrating agent; sodium silicofluoride, which is recommended by Hall as a mildew preventive for wool and also a moth preventive. Admitting that it is not always easy to allocate blame for mildew damage, the author lists five factors to be considered in placing blame for mildew damage. (C)

PARAFFIN WAXES, STEARINE AND SIMILAR SUBSTANCES: THE EXAMINATION OF. Fr. Dangl. *Mell. Tex. Mo.*, Sept., 1932, P. 368.

An editorial abstract states the technical literature dispersedly contains statements concerning the possibility of ascertaining the presence of paraffin wax in mineral oils by using polarized light. No reference, however, has been made as yet to the practical value of this method of investigation. In this connection may be mentioned the research works done by Dr. Leo Gurwitsch, L. Emaneuli, E. Da Fano, Y. Tanaka. The purpose of the author in entering on these investigations was to exploit the optical anisotropy with a view to further findings. (S)

PH CONTROL BY COLORIMETRIC METHODS: SOME NOTES ON. John Muir. *J. Soc. Dyers & Col.*, Vol. XLVIII, No. 8, P. 225.

A brief explanation of the meaning of pH and the pH scale is contained in this article. Also a reference to the pioneer work in the use of colored indicators for measuring pH by early workers including Sörensen. Mention is made of the theory of the action of indicators. Some of the various difficulties experienced in the use of indicators and how to surmount

them are enumerated, such as dichromatism, salt effects, turbidity, etc. The use of buffer solutions is explained and reference is made to the many practical applications of pH control by the indicator method. The uses of the tube comparator, Wülff and Hellige Disc comparator methods are quite completely described. A very good list of references to the literature is also given. (D)

PRE-BOIL CHEMIC STEEP: REPORT OF AN INVESTIGATION OF A. J. Andrew Clark. *Cotton,* 1932, Vol. 96, No. 7, P. 28–29.

Describes and tabulates results of giving grey cottons a preliminary steep before single kier boiling, and summarizes conclusions as follows: "1. A preliminary chemic can be used to advantage before the regular caustic boil. 2. With a change in formula of the caustic boil designed especially to increase the wax removal, a bleach can be obtained of somewhat superior color with decrease in operating cost over that of the two boil routing. 3. Fully as good white can be obtained with a single boil preceded by a chemic steep as is obtained with the double boil operation." (C)

STARCH PASTE: SOME PHYSICAL PROPERTIES OF; WHICH AFFECT THEIR STIFFENING POWER ON FABRICS. Margaret S. Furry. *Tech. Bull. No. 284,* published by U. S. Dept. of Agriculture.

The author states that the size of the starch granule determines the consistency of the paste, which, in turn, is largely responsible for the penetrating and coating powers of the paste. It is further stated that best penetration is obtained with those starches made up of the smallest granules—dasheen, rice, and wheat are of this type. The best coating is obtained with starches composed of large granules such as canna, corn starch, and potato starch. The latter is said to penetrate least of those tested and to be composed of granules of so large dimensions as to make even coating difficult, thus providing insufficient stiffness. (S)

WATER: PURIFYING; FOR THE TEXTILE INDUSTRY. S. B. Applebaum. *Water Works and Sewerage,* 1932, 79, 47–51, 83–6.

Requirements of various textile processes discussed and the zeolite process of softening is considered satisfactory. Installations are described for purification in a cotton finishing plant, a carpet factory and a rayon factory. (W)

WETTING AGENTS: DISCUSSION ON. *J. Soc. Dyers & Col.,* Vol. XLVIII, No. 8, P. 219.

This article contains a brief account of the fundamental physics of wetting and an extensive discussion of various methods of evaluating the various wetting-out agents. Throughout the discussion, emphasis is placed on the evaluation of a wetting-out agent in the laboratory under conditions of its practical use, such as the fibre to be wetted, dilution pH, temperature, etc. An interesting electrical method of testing by H. A. Turner and R. S. Parry is described. The article contains some very interesting viewpoints on the much mooted question of how to evaluate wetting-out materials in the laboratory. (D)

WOOL FIBRE: THE BEHAVIOR OF; TOWARD CHROMIUM TRIOXIDE AND DICHROMATES. Robert Haller and H. von Hove. *Helv. chim. acta*, 1932, 15, 357–75.

The absorption of CrO_3 and of $K_2Cr_2O_7$ on wool fibres follows parabolic curves when plotted against percentage in solution or against time. For the same percentage in solution and time, CrO_3 is adsorbed in greater amounts than is $K_2Cr_2O_7$. Fibres so treated behave as follows as to oxidizing influence of chromium compounds, determined by tests of strength and elongation: In sunlight, strongly attached in air, slowly in water, very strongly in del. H_2SO_4; in the dark these effects are retarded, requiring days or weeks in some cases. The accelerating effect of H_2SO_4 is retarded by the addition of Glauber salt. (W)

IV. RESEARCH METHODS AND APPARATUS

MAGNIFIERS: THREE TEXTILE. *Instr. Wld.*, 1932, 5, P. 11.

Two magnifiers are somewhat similar and operate on the same principle. The "Luminex" by Beck has a fountain-pen-type handle carrying a small battery and bulb. A reflector at the one end directs the light downward on the specimen. Above is mounted a 10 X magnifier. Three forms are made available: one fixed and one variable focus, also one equipped with graduated scale for mounting. The Zeiss magnifier consists of a hollow hemisphere and reflecting inner surface. On one side is mounted an illuminator. Opposite is a handle for manipulating the instrument. A series of base plates are obtainable to assist in counting. A slot in the side permits the admission of a counting needle. The "Speera" magnifier by Watson is of the binocular type and is made in the form of a pair of spectacles. Magnifications of 1¾ X, 2½ X, and 3½ X are available. (Copied from *Bausch and Lomb Abstract Bulletin*, Aug., 1932.) (S)

OPACITY METER. *Elec. Jnl.*, Jan., 1932, P. 31.

Paper which lets printing on one side show through from the other is justly held in contempt. The important thing in avoiding this is not mere thickness, but opacity. A thin opaque paper is better than a thick translucent one, and of course means thinner magazines, less postage.

This elusive property may soon need no longer be judged by eye. An opacity meter, not yet on the market, indicates instantly in percent the amount of light which can pass through a sample of any material. It is a box less than a foot cube containing a lamp and a photo-cell, with a slit between (in which a sample can be placed) a micro-ammeter, and adjuncts. A first reading is taken with nothing in the slit, which establishes 100% transparency. A second reading, with a sample in the slit between lamp and photo-cells reads on the micro-ammeter as transparency in percent. Application to textile materials will be apparent. (S)

THREAD COUNTER: SIMPLE. E. Leitz. *Instr. Wld.*, 1932, 5, P. 14.

Consists of a magnifier (10 X) mounted on a carriage actuated by a micrometer screw. A graduated scale and an index line engraved on a prism which passes over the textile provides means of counting. (Copied from *Bausch & Lomb Abstract Bulletin*, Aug., 1932.) (S)

V. Economic Research and Miscellany

Taxable Value of Manufacturing Properties. Charles T. Main. *Mech. Eng.*, 1932, July; *Cotton*, 1932, Vol. 96, No. 8, P. 17–19.

Described by the latter as follows: "There seems to be no satisfactory method for determining a fair basis for taxation of industrial plants, and the suggestions herein are made in an endeavor to set up a logical method of getting a closer approximation of values for the purpose of taxation than has been used for the past few years or is now in use." (C)

Textile Mill Valuations: Overcoming Inequalities in. Anon. *Tex. Wld.*, 1932, Vol. 82, No. 1, P. 50–51.

Based in large part upon article of Charles T. Main (*Mech. Eng.*, 1932, July). Concludes as follows: "The most valuable tools for the manufacturer unfairly taxed are figures showing competitive situation, figures on reasonable valuation of property and data on the economic question of whether the mill may not be better off to close down and either sell or tear down the buildings—with figures on the prices brought at recent sales of mill properties as background material."

"A scientific check up of the premises on which textile technique is based would displace theory and guess work with exact knowledge and scientific control."—Scientific Textile Research.

Bibliography

I. Fibres (Synthetic and Natural) and Fibre Analysis

Alpaca Fibres: Microscopic Study of. H. S. Schenker and L. S. Potsdamer. *Mell. Tex. Mo.*, 1931, 3, 297–8. (W)

Angora Rabbit Wool. William H. Butler. *Tex. Wld.*, 1932, Vol. 82, No. 3, P. 78–9.
Describes characteristics, sources, uses, history and present status. (C)

Emulsification. J. B. Speakman and N. H. Chamberlain. *Nature*, Aug. 20, 1932, P. 274.
It is stated that the difficulty in removal of mineral oil from wool increases in proportion to the length of the molecule. (S)

Emulsion Oiling of Wool. J. B. Speakman and H. Franks. *J. T. I.*, July, 1932, P. 154.
The data indicate that the use of wool creams gives a far stronger yarn than the normal practice of using oil, especially under conditions of rapid working. (S)

Feather Keratin: X-Ray Interpretation of the Molecular Structure of. W. T. Astbury and Thora C. Marwick. *Nature*, Aug. 27, 1932, P. 309.
Work on feather, horn, and other structures is beginning to be correlated with studies on wool and hair. The influence of stressing is emphasized. (S)

Horsehair Paddions: New Investigations on. G. Herzog. *Mell. Textilber.*, Aug., 1932, P. 405–7.
A short article outlining a number of physical tests on some seven samples of hair. (S)

Proteins and Osmotic Swelling: The pH Stability Region of. D. Jordan Lloyd. *Nature*, July 2, 1932, P. 24.
Work on gelatin collagen, silk, and wool. (S)

II. Yarns and Fabrics

Carpet Beetle: The Destructive Influence of the; On Wool Textiles. Dr. Adolf Herfs. *Mell. Textilber.*, July, 1932, P. 349.
A review of the literature in this field together with the effects of certain chemical treatments as preventatives. (S)

COUNTS OF WOOL YARNS: THE MEASURING OF YARN LENGTHS FOR THE DETERMINATION OF. Carl Kusebauch. *Mell. Textilber.*, Aug., 1932, P. 407–9.

An interesting apparatus, involving a precision yarn reel for the measurement of yarn as it is transferred from one package to another, is described. The machine is motor driven and operates at a constant speed of 100 meters per minute. (S)

DUST FILTER FABRICS: TESTING. B. Rabinowitsch. *Mell. Textilber.*, 1930, 11, 847–8. (W)

EFFECTIVE MIXING DEMANDED BY WEAK COTTONS. Alfred K. Landau. *Tex. Wld.*, 1932, Vol. 82, No. 2, P. 68–69.

The author describes what might be termed a one-process feeding, mixing, opening and cleaning system for cotton. Flexibility in blending is accomplished by providing a series of by-passes which permit the inclusion or exclusion of certain of the cleaning machines. The disadvantages and inefficiencies of the stack mix and the use of the bale breaker as a mixing medium are described. (C)

POROSITY: MEASUREMENT OF. Guy Barr. *Am. W. & C. Rptr.*, 1932, Vol. XLVI, No. 37, P. 13–16.

Draws attention to certain points that arise in the specification of porosity, and describes the design and operation of apparatus for the testing of fabric porosity that requires no delicate adjustments and is claimed to be suitable for mill use. (C)

RAYON MANUFACTURE: THE YEAR'S TECHNICAL DEVELOPMENTS IN. Harold DeWitt Smith. *Tex. Wld.*, 1932, Vol. 82, No. 3, P. 56–57.

Brief description of the latest developments in this field by the author of the chapter in TEXTILE RESEARCH: A SURVEY OF PROGRESS on Rayon Fibre Research. (C)

SILK EVENNESS: NINE-METER SIZINGS FOR MEASURING. Warren P. Seem. *Tex. Wld.*, 1932, Vol. 82, No. 2, P. 70–72.

Gives details proving the dependability of the system (originally described in Textile World, Oct. 24, 1931) for giving "a relative evenness valuation on all sizes of raw and thrown silk, rayon, combination, spun silk, and cotton yarns." States that the method has been presented to the Raw Silk Classification Committee and to the Japanese Government conditioning houses. (C)

SPINNING QUALITY OF COTTON: INFLUENCE OF MECHANICAL ADJUSTMENTS ON THE. H. H. Willis. *Cotton*, 1932, Vol. 96, No. 7, P. 15–17, 29.

The great variation in fibre length that exists in a bale of any so-called length of cotton is emphasized, methods of determining this variation are explained, and also this knowledge can be used with profit through the adjustment of drafting rolls. (C)

STRENGTH AND ELONGATION OF YARN: TESTING THE. E. Moller. *Mell. Textilber.*, 1930, 2, 658–60, 787–90. (W)

III. Chemical and Other Processing (Not Otherwise Classified)

Azo Dyes: The Reaction Mechanism of the Diazonium Salts and Anti-Diazotates in the Formation of. E. Möhlau. *Chem'ztg.*, 1932, 56, 305–6.

A review and discussion of the literature on these types of compounds and their effects on coupling reactions. (Copied complete from *Chem. Abs.*, 1932, 26, 3670.) (W)

Bleaching Mohair Plush: Strict Control is Necessary in. Fred Archer. *Tex. Wld.*, 1932, Vol. 82, No. 2, P. 95.

Gives objections to sulphur dioxide bleach; describes hydrogen peroxide method and preference for it. (C)

Blue Sulfur Dyes: The Structure of. Ed. Bernasconi. *Helv. Chim. Acta.*, 1932, 15, 287–314.

Studies were made on the following: Pyrogene-indigo (Ciba); Immedial indone JBN (Cie. Mat. Colorantes) Hydrone Blue (I. G.). Structural formulas are given. (W)

Enzyme Action in the Textile Industries. W. F. Edwards. *Proc. Amer. Soc. Testing Materials, No. 76* (reprint) 8 pp., 1932.

A review. (W)

Fastness of Dyes: New Method of Evaluating. J. Pinte. *Chim. et Ind.*, Special No. Mar., 1932, P. 534–41.

An explanation of the use of the T. C. B. photo-electric photocolorimeter (C. A. 21, 3492) for measuring the fading of dyes on fabrics. (Copied complete from *Chem. Abs.*, 1932, 26, 3671.) (W)

Quinone Oxime Colors. G. Salomone. *Boll. laniera*, 1931, 45, 836–9.

Their production and properties are described. (W)

IV. Research Methods and Apparatus

Fibres: A New Method for Measuring. H. Meyer. *Mell. Textilber.*, 1931, 12, 683–6, 743–5. (W)

Fibre Quality: The Determination of Absolute; By Microdetermination of Strength of Finished Products. F. Schubert. *Mell. Textilber.*, 1931, 12, 100–3, 177–8. (W)

Fluorescence Analysis of Textiles by Contact Photography. H. Perndanner. *Mell. Textilber.*, 1930, 11, 600–3, 687–8. (W)

Microscopy, Photomicrography and Microprojection: A New Apparatus for; Adapted to Textile Investigation. F. Lossen. *Mell. Textilber.*, 1930, 11, 767–8. (W)

SIZED AND UNSIZED COTTON WARPS: TENSILE STRENGTH TESTS. A. H. Grimshaw. *Mell. Tex. Mo.*, 1930, 2, 1050–6, 1178–81. (W)

TENSILE STRENGTH: TWO METHODS OF CALCULATING COMPARISONS IN. V. B. Moore. *Mell. Tex. Mo.*, 1930, 2, 1176–81. (W)

V. ECONOMIC RESEARCH AND MISCELLANY

A MERGER PLAN. Floyd W. Jefferson. *Tex. Wld.*, 1932, Vol. 82, No. 2, P. 50–51.

The author proposes as a stabilizer in cotton goods distribution a definite plan for a merger of cotton goods seeling agencies, and sets down specific fundamentals. (C)

A MODERNIZED COTTON MILL. Frank W. Reynolds. *F. & F.*, 1932, Vol. 85, No. 2484, P. 10–16. (Reprint from *Commerce and Finance.*)

The author takes the reader on an imaginary tour through a print cloth plant, built some twenty years ago, that has been brought up-to-date. (C)

FLEXIBLE WORK WEEK. Henry P. Kendall. *Tex. Wld.*, 1932, Vol. 82, No. 3, P. 77.

Presents essential details of the Davis plan for re-employing workers which has the endorsement of the Massachusetts commission on stabilization of employment, of which Mr. Kendall is a member, and which has been presented to President Hoover. (C)

RAYON PLANT: PREVENTING CORROSION IN THE. Theodore R. Olive. *Tex. Wld.*, 1932, Vol. 82, No. 3, P. 68–70.

Although the need of finding suitable corrosion-resistant materials has not been a major problem of the rayon industry, it has been rendered more important as quality requirements have become more stringent, and the author describes those that meet the various needs of rayon plants. (C)

Publications Abstracted

A Key to Abbreviations of Publications Used in Abstracts and Bibliography

Am. Dye. Rptr. .....*American Dyestuff Reporter*
Am. Silk & Rayon Jnl. .....*American Silk & Rayon Journal*
Am. W. & C. Rptr. .....*American Wool & Cotton Reporter*
Ann. Appl. Biol. .....*Annals of Applied Biology*
Ber. Deut. Chem. Ges. .....*Berichte der Deutschen Chemischen Gesellschaft*
Biol. Abs. .....*Biological Abstracts*
Bur. Stds. J. Rsch. .....*Bureau of Standards Journal of Research*
Can. J. Rsch. .....*Canadian Journal of Research*
Cell'chem. .....*Cellulosechemie*

Chem. & Met. ..... *Chemical & Metallurgical Engineering*
Chem'ztg. ..... *Chemikerzeitung*
Chem. Abs. ..... *Chemical Abstracts*
Chem. W'blad. ..... *Chemische Wocheblad*
Chem. Zent'Blatt. ..... *Chemisches Zentralblatt*
Chim. et Ind. ..... *Chimie et Industrie*
Elec. Jnl. ..... *Electrical Journal*
F. & F. ..... *Fibre and Fabric*
Giorn. chim. ind. appl. ..... *Giornale di chimica industriale 'ed applicata'*
Helv. chim. acta. ..... *Helvetica chimica acta*
Ind. Chim. ..... *Industria Chimica*
Instr. Wld. ..... *Instrument World*
J. Am. Chem. Soc. ..... *Journal of the American Chemical Society*
J. Bio. Chem. ..... *Journal of Biological Chemistry*
J. Cell. Inst. (Tokyo) ..... *Journal of the Cellulose Institute* (Tokyo)
J. Chim. Phys. ..... *Journal de Chimie Physique*
J. Ind. & Eng. Chem. ..... *Journal of Industrial and Engineering Chemistry*
J. Ind. Chem. ..... *Journal of Indian Chemistry*
J. Op. Soc. Am. ..... *Journal of the Optical Society of America*
J. Phys. Chem. ..... *Journal of Physical Chemistry*
J. Prakt. Chem. ..... *Journal of Praktikum Chemie*
J. Rheo. ..... *Journal of Rheology*
J. Soc. Chem. Soc. (Japan) .. *Journal of the Society of Chemical Industry* (Japan)
J. Soc. Dyers & Col. ..... *Journal of the Society of Dyers and Colourists*
J. T. I. ..... *Journal of the Textile Institute*
Kolloid Z. ..... *Kolloid Zeitschrift*
Leipzig. Monats. Tex. Ind. ... *Leipziger Monatschrift fur Textile Industrie*
Mech. Eng. ..... *Mechanical Engineering*
Mell. Textilber. ..... *Melliand's Textilberichte*
Mell. Tex. Mo. ..... *Melliand Textile Monthly*
Natur. ..... *Naturwissenschaften*
Papier-Fab. ..... *Papierfabrikant*
Rev. gen. mat. color. ..... *Revue generale des matieres colorantes*
Rev. Gen. Mat. Plast. ..... *Revue Generale des Matieres Plastiques*
Spinn. u. Web. ..... *Spinner und Weber*
Tex. Am. ..... *Textile American*
Tex. Col. ..... *Textile Colorist*
Tex. Mfr. ..... *Textile Manufacturer*
Tex. Wkly. ..... *Textile Weekly*
Tex. Wld. ..... *Textile World*
Z. anal. Chem. ..... *Zeitschrift fur analytische Chemie*
Z. Angew. Chem. ..... *Zeitschrift fur Angewandte Chemie und Zentralblatt fur technische Chemie*
Z. Phys. Chem. ..... *Zeitschrift fur Physikalische Chemie*

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